NOLOGY DEPARTMENT

POWER

MAY 1947

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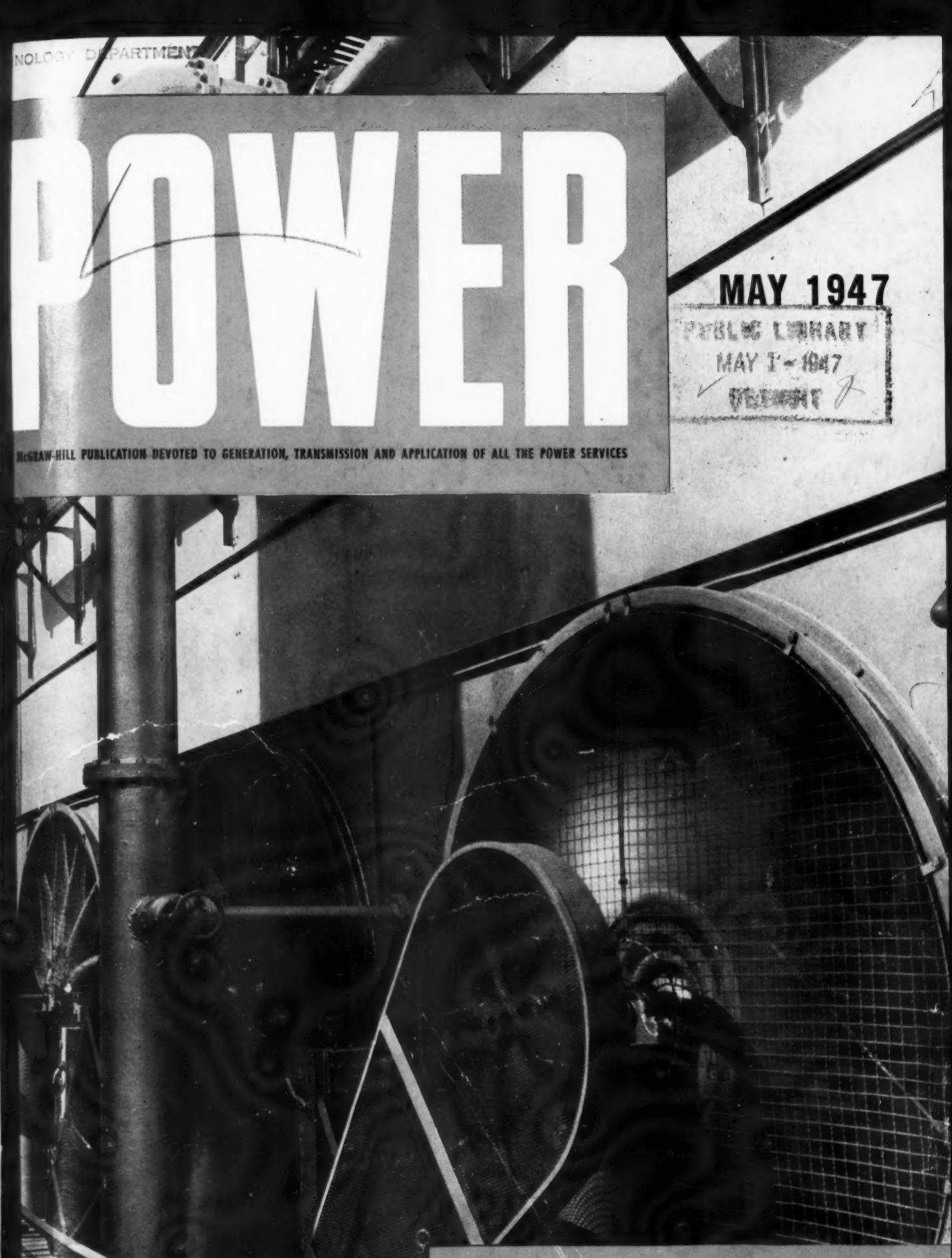

This issue features: What eleven design and operating engineers learned about outdoor and semi-outdoor plants, p 72. Who's who in atomic power control, p 64. How progress in aircraft gas turbines aids in stationary design, p 102. Motor-selection pointers, p [illegible]

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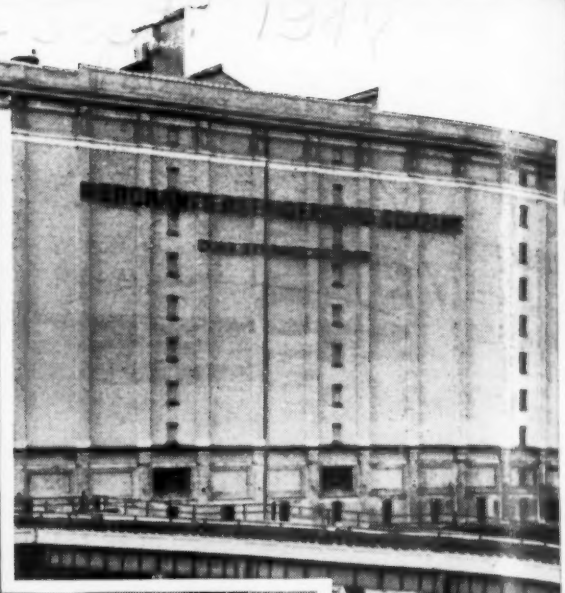


Piping to heat exchanger for ammonia and brine, Merchants Refrigerating Co., New York City. Arrows lead from detecting Thermohms to recording Micromax instruments.

Top Recorders are for temperature; bottom ones, for temperature-difference.

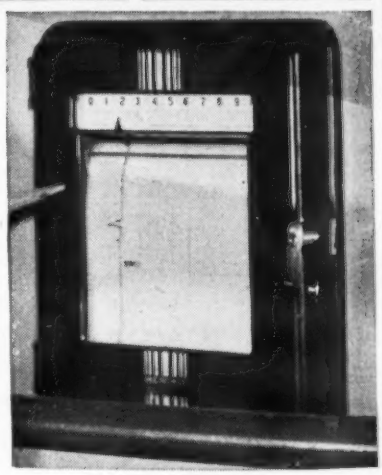
Efficient Refrigeration Helped By Micromax Recorders

Refrigeration temperatures are easier to observe, and can be read more exactly, when Micromax Recorders provide centralized records of temperature and temperature-difference.

Micromax is giving this kind of help to Merchants Refrigerating Company, in cold storage of food. One 10-point and two 16-point instruments record the temperatures of brine, liquid and gaseous ammonia, and water. Three Micromax Temperature-Difference Recorders are used on the calcium chloride brine.

An engineer of the Company says that, when stem thermometers were used for these temperatures, "no two men read alike", and there was often additional error in writing down the readings. Accuracy has been helped by Micromax records—all made by constant, dependable balance mechanisms, and all in one place, so that they can be checked and rechecked quickly. Sensitivity and faithful recording of tiny temperature changes make it easier for engineers to run temperatures very close to the critical points, and so achieve greater refrigerating efficiency.

Catalog N-33C, describing Micromax with Thermohms, will be sent on request. Or, if you prefer, an L&N engineer will be glad to call or write.



Closeup of Micromax Recorder, bottom center of panel. It shows temperature-difference of brine. Note clear record of temperature-surge which occurred when one of two compressors was taken off line.

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

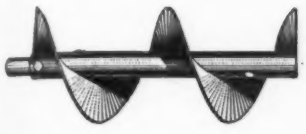
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

Jrl. Ad. N-33C-221(2)

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), May, 1947, Vol. 91 No. 5. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions $5 for one year, $8 for two years. 50c per copy. Canada, $6 for one year, $9 for two years. Pan American, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years.

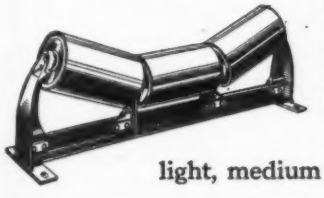
Move Bulk Materials *cheaper* the LINK-BELT way

. . . by Screw Conveyor — — —



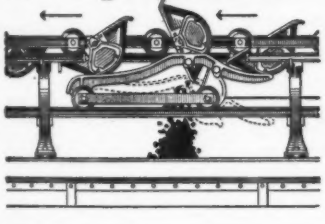
Link-Belt manufactures Helicoid, the original continuous flight screw conveyor. Other Link-Belt screw conveyor equipment includes sectional-flight, ribbon and paddle conveyors, as well as a complete line of accessories, such as collars, couplings, hangers, troughs, box ends, flanges, thrusts and drives.

. . . by Belt Conveyor — — —



Link-Belt makes all types of troughing, flat-roll, return and self-aligning idlers, including all accessories, such as trippers, belts, pulleys, bearings, take-ups, etc., for handling a wide range of materials, for light, medium and heavy-duty service.

. . . by Bucket Carrier — — —



There is a type of Link-Belt bucket carrier and bucket elevator for every service—horizontal, vertical or inclined—for handling all kinds of materials at desired capacities. Illustrated is the Peck Overlapping Pivoted Bucket Carrier.

. . . by Bulk-Flo Conveyor

Simple . . . Versatile . . . Compact . . . Enclosed. Economically handles flowable, granular, crushed, ground or pulverized materials of a non-abrasive, non-corrosive nature in a continuous mass, horizontally, vertically or on an incline, in a single unit. Bulk-Flo is easily adaptable to practically any surroundings.

LINK-BELT COMPANY, ***The Leading Manufacturer of Conveying and Mechanical Power Transmission Machinery***

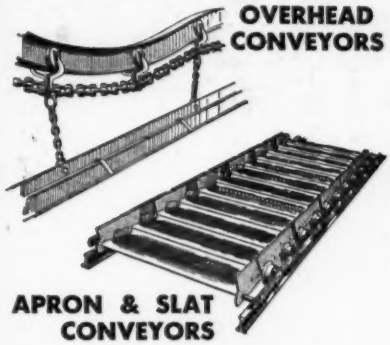
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities. 10,600

• • •

Conveyors and elevators are called upon to do an endless variety of tasks. Each presents its own problems . . . each requires its own solution. From the design to the erection of your conveyor system . . . Link-Belt offer experience, backed by thousands of installations and foresight that has established their reputation as pioneers in the field of continuous movement of materials.

LINK-BELT *makes conveyors for every purpose —*

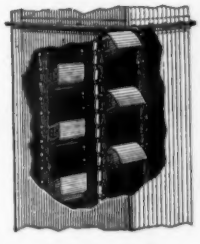
. . . for lifting materials or lowering them —
. . . for moving parts and packaged materials —
. . . for conveying parts into machines for processing —

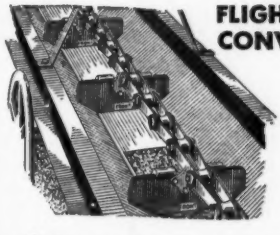


OVERHEAD CONVEYORS

APRON & SLAT CONVEYORS

BUCKET ELEVATORS





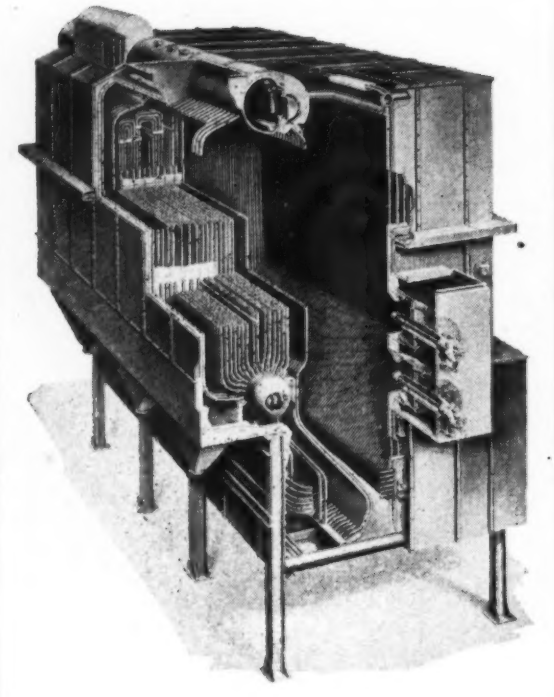
FLIGHT CONVEYORS

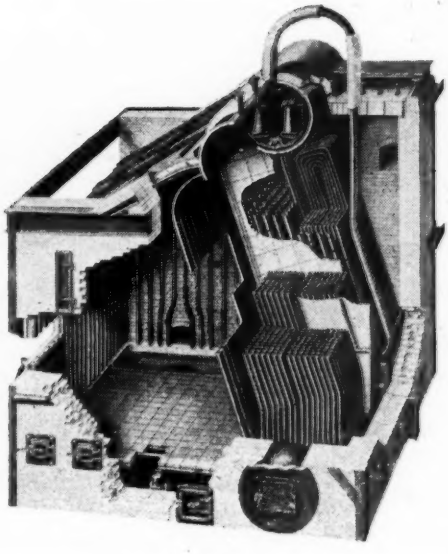
OSCILLATING-TROUGH CONVEYORS

LINK-BELT *Conveyors*

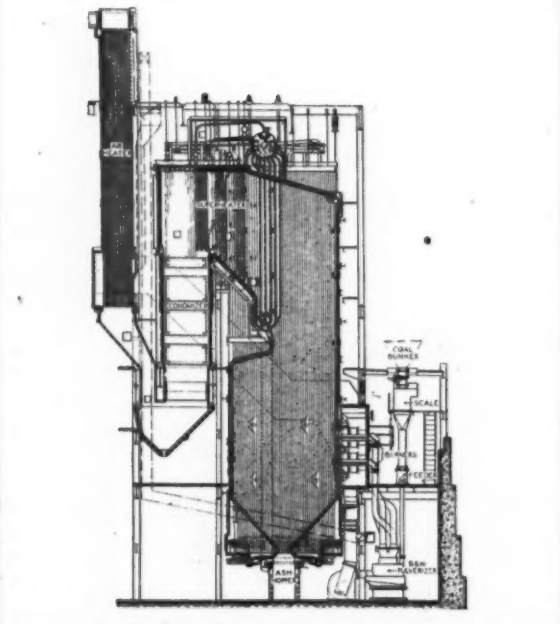
A TYPE FOR EVERY KIND OF MATERIALS HANDLING

Modernize with B&W BOILERS *for*

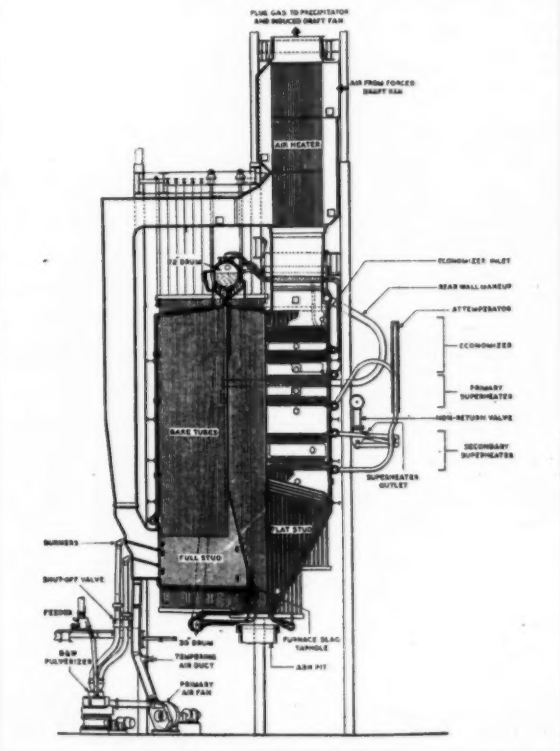




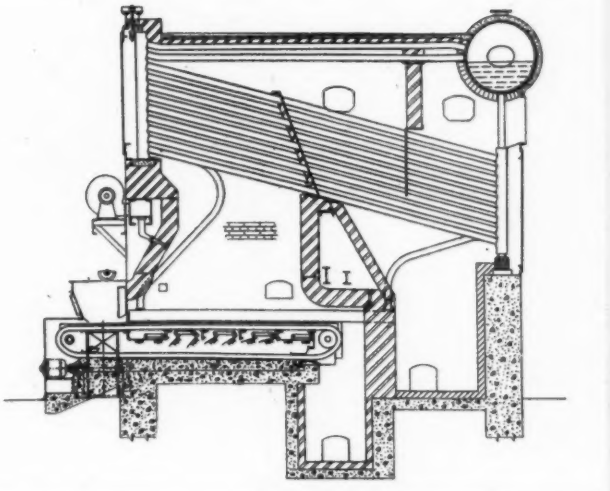
INTEGRAL-FURNACE BOILER—The Integral-Furnace Boiler is a completely co-ordinated unit built in a wide range of steam capacities and for pressures and temperatures required by the most up-to-date and efficient prime movers. It is designed to burn pulverized solid fuels, oil, or gas, singly or in any combination, thus utilizing at high combustion efficiency the least expensive fuel obtainable in any locality.



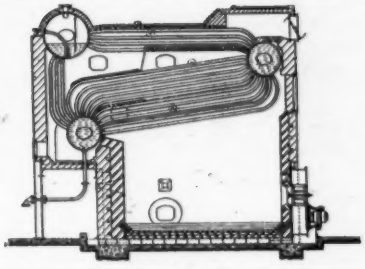
CENTRAL STATION BOILERS—High-duty boilers for central-station service are available in several basic designs that meet the requirements of individual stations. The boilers illustrated are typical of some of the units now operating at high capacities in utility plants.



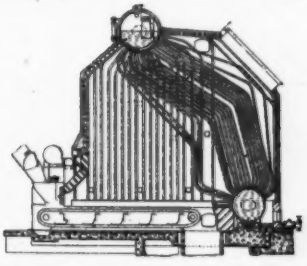
LOW COST STEAM



B&W DESIGN 32 CROSS-DRUM BOILER — This boiler is an attractive unit for small and medium-size power plants where refractory furnaces are suitable. It provides the advantages of the straight-tube, sectional-header construction used in B&W Cross-Drum Boilers designed for larger capacities.

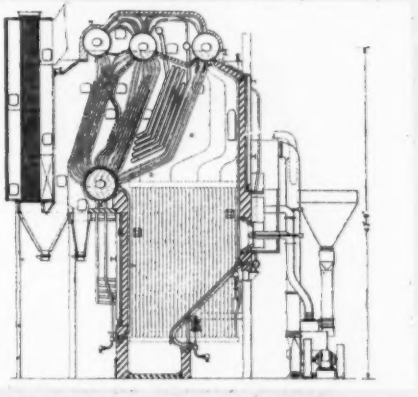


TYPE H STIRLING BOILER — A low-head moderate-pressure unit that fulfills the requirements of small industrial plants, institutions, hotels, office buildings, and similar installations. Available in capacities ranging from 1500 to 30,000 lb. steam per hr. and for firing with any fuel. The furnace, usually of refractory, provides the necessary degree of dependability.



B&W INTEGRAL-FURNACE BOILER (CLASSES 9, 12, & 15) — This Integral-Furnace Boiler design is available for firing with stokers or with oil. Having a water-cooled furnace of special design, this boiler provides the dependability of central-station boilers, with efficient and smokeless combustion.

The time-tested, performance-proved boiler designs shown on these pages are big reasons why so many industrial and utility power men come to B&W again and again when modernization or expansion of power plant facilities calls for new steam-generating equipment. They know from long, satisfactory experience that B&W boilers are soundly designed, built and applied to fulfill the specific conditions of each job; embody the very latest developments; and, therefore, consistently give the high standards of performance essential to low-cost steam generation. They know too that from B&W, they get the benefit of nearly 80 years of valuable experience in solving boiler requirements—experience that cannot be written into specifications or shown on blue-prints but is reflected in all B&W steam-generating equipment.



STIRLING BOILER — The Stirling Boiler fully meets the requirements of modern operating conditions in industrial plants and central stations. It readily responds to sudden and heavy demands for steam, and delivers dry steam at relatively high ratings when operated with water having a high concentration of solids. May be fired with any fuel.

G-351

Water-Tube Boilers, for Stationary Power Plants, for Marine Service . . . Water-Cooled Furnaces . . . Superheaters . . . Economizers . . . Air Heaters . . . Pulverized-Coal Equipment . . . Chain-Grate Stokers . . . Oil, Gas and Multifuel Burners . . . Seamless and Welded Tubes and Pipe . . . Refractories . . . Process Equipment.

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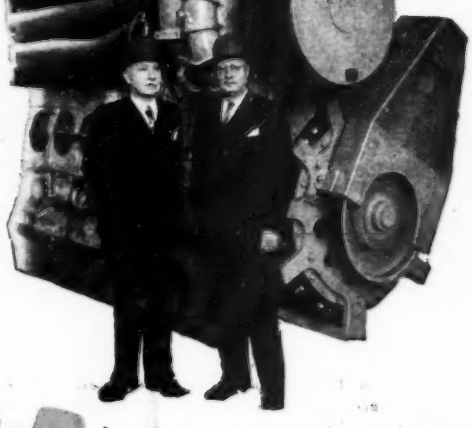
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

DISTINGUISHED VISITOR

DR ALFRED J. BUCHI of Switzerland, who conceived and developed the Buchi system of turbocharging, has been in the United States for several months. He is shown (left) with C. F. Harms, manager of the supercharger department of Elliott Company, in the plant of the Baldwin Locomotive Works. Dr. Buchi and Mr. Harms made an extended tour among the builders of four-cycle engines in the interest of better application of turbochargers.

Dr. Buchi was effective in starting the use of the Buchi system in Europe just after World War 1. Although America did not take it up until shortly before World War II, American production already exceeds European.



Elliott BUCHI

They turn Diesel exhaust into added power!

50% POWER INCREASE IN A GIVEN SIZE DIESEL ENGINE. This is proved in the thousands of Diesel installations equipped with Elliott-Buchi turbochargers.

There is power in Diesel exhaust — power to turn a turbine which drives a blower to force fresh air into the cylinders, for better scavenging and combustion. The Elliott-Buchi turbocharger simply exchanges "new air for old" — a mighty beneficial exchange for any four-cycle Diesel.

Control is automatic, too. The volume of engine exhaust dictates the speed of the blower, and adjusts it to the needs of the engine in speed or load changes. And since there is no mechanical connection between engine and turbocharger, the engine can reverse without reversing the turbocharger. This makes it ideal for use in locomotive and marine Diesels. Another ideal application is high-altitude installations, where the turbocharger makes thin air give sea-level performance.

When considering a Diesel installation, check on what the Elliott-Buchi turbocharger would save you, in engine weight and size, in smoother, more positive operation, in fuel and lubricating oil savings. Talk it over with Elliott engineers. Bulletin on request.

NOW USED BY ALL BUILDERS OF FOUR-CYCLE DIESELS

Here are names that mean plenty in the Diesel world. They all use Elliott-Buchi turbochargers, fitting them with no difficulty to engines of distinctively different design:

American Locomotive Company
Atlas Imperial Diesel Engine Co.
Baldwin Locomotive Works
Busch-Sulzer Bros. Diesel Engine Co.
The Buckeye Machine Co.
Chicago Pneumatic Tool Co.
The Cooper-Bessemer Corporation
Enterprise Engine & Foundry Co.
Fulton Iron Works Company
General Machinery Corporation
Ingersoll-Rand Company
The National Supply Companies
Nordberg Manufacturing Co.
Sterling Engine Company
The Union Diesel Engine Co.
Washington Iron Works
Worthington Pump and Machinery Corporation

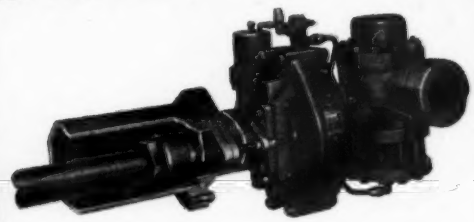
ELLIOTT COMPANY
Supercharger Department, **JEANNETTE, PA.**
Plants in: **JEANNETTE, PA. • RIDGWAY, PA. • SPRINGFIELD, O. • NEWARK, N. J.**
DISTRICT OFFICES IN PRINCIPAL CITIES

M-90

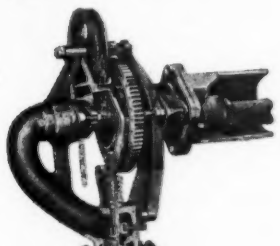
TURBOCHARGERS

Typical Central Stations Installed or Under

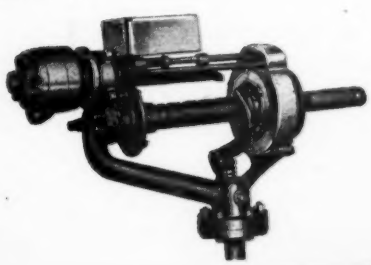
DIAMOND Model A2E Automatic Air Puff Soot Blowers



DIAMOND Model G9B Soot Blowers



DIAMOND Model IR Short Retracting Soot Blowers



Compiled by B G A Skrotzki
Assistant Editor

Company	Location	Plant Name	Consulting Engineers
1000 PSI AND ABOVE			
Consolidated Edison Co of N Y	Bronx, NYC, N. Y.	Sherman Creek	
Pacific Gas & Electric Co	Oleum, Calif	Oleum	
Columbus & So. Ohio El Co	Nr Columbus, Ohio	Walnut	United Lt & Pwr Serv
Commonwealth Edison Co	Chicago, Ill.	Fisk	Sargent & Lundy
Illinois Northern Utilities Co	Dixon, Ill.	Dixon	Sargent & Lundy
New Orleans Pub Serv Inc	New Orleans, La.	Industrial Canal	Ebasco Services
Pennsylvania Power & Light Co	Hauto, Pa.	Hauto	Ebasco Services
Pennsylvania Power & Light Co	Nr Sunbury, Pa.	Sunbury	Ebasco Services
800 TO 999 PSI			
Columbus & So. Ohio El Co	Nr Columbus, Ohio	Picway	United Lt & Pwr Servic
Wisconsin Pwr & Lt Co	Beloit, Wis	Blackhawk	Sargent & Lundy
Consolidated Edison Co of N Y	Bronx, NYC, N. Y.	Hell Gate	
The Ohio Public Service Co	Warren, Ohio	Mahoningside	Electric Advisers
Connecticut Lt & Pwr Co	Devon, Conn.	Devon	United Engrs
Gulf Power Co	Pensacola, Fla.	Pensacola	Comm & So. Corp
Staten Island Edison Corp	Travis, S. I., N. Y.	Arthur Kill	Gilbert Assoc
El Paso Electric Co	New Mexico	Rio Grande	Stone & Webster
Consol Gas, El Lt & Pwr Co, Balto	Turner, Md.	Riverside	
The Detroit Edison Co	Marysville, Mich.	Marysville	
Houston Ltg & Pwr Co	Nr Houston, Texas	W Junction	Ebasco Services
Illinois Power Co	Havana, Ill.	Havana	Sargent & Lundy
Indianapolis Pwr & Lt Co	Indianapolis, Ind.	Harding St.	Gibbs & Hill
New Orleans Pub Serv Inc	New Orleans, La.	Market St.	Ebasco Services
Southwestern Public Serv Co	Borger, Texas	Riverview	
Tennessee Valley Authority	Spring City, Tenn.	Watts Bar	Chas T Main
The Ohio Public Service Co	Shadyside, Ohio	R E Burger	Electric Advisers
Iowa-Illinois Gas & El Co	Moline, Ill.	Moline	United Service Co
Iowa-Illinois Gas & El Co	Davenport, Iowa	Riverside	United Service Co
Madison Gas & Electric Co	Madison, Wis.	Blount St.	
Southern Indiana Gas & El Co	Evansville, Ind.	Ohio River	Comm & So Corp
600 TO 799 PSI			
Public Service Co of Ind, Inc	Terre Haute, Ind.	Dresser	Sargent & Lundy
Sioux City Gas & Elec Co	Sioux City, Iowa	Kirk	B F Wood
Pennsylvania Electric Co	Seward, Pa.	Seward	Gilbert Assoc
Potomac Electric Pwr Co	Washington, D. C.	Buzzard Pt.	Stone & Webster
Wisconsin Public Service Corp	Green Bay, Wis.	Bayside	Public Ut Engr & Serv
Central Illinois El & Gas Co	Rockford, Ill.	Rockford	Stone & Webster
New York State El & Gas Corp	Bainbridge, N. Y.	Jennison	Gilbert Assoc
Pacific Gas & Electric Co	Eureka, Calif.	Station B	
Eastern Shore Pub Serv of Va	Vienna, Md.	Vienna	United Engrs & Cas
Dallas Pwr & Lt Co	Nr Dallas, Texas	Mountain Creek	Ebasco Services
Louisville Gas & El Co	Louisville, Ky.	Canal	Public Ut Engr & Serv
Louisville Gas & El Co	Louisville, Ky.	Paddys Run	Public Ut Engr & Serv
Public Service Co of Okla	Tulsa, Okla.	Tulsa	Sargent & Lundy
Superior Water, Lt & Pwr Co	Superior, Wis.	Winslow	
Gulf States Utilities Co	Baton Rouge, La.	Louisiana	Stone & Webster
Interstate Pwr Co	Clinton, Iowa	Beaver Channel	Sargent & Lundy
Southwestern Public Serv Co	Carlsbad, N. M.	Carlsbad	
Southwestern Public Serv Co	Clovis, N. M.	Clovis	
400 TO 599 PSI			
Iowa-Illinois Gas & Elec Co	Fort Dodge, Iowa	Fort Dodge	H A Kleinman
Central Ohio Light & Power Co	Bluffton, Ohio	Woodcock	Sargent & Lundy
Nappanee Utilities Co	Nappanee, Ind.	Nappanee	Laramore & Douglass
Northern States Power Co	La Crosse, Wis.	French Island	
Iowa Public Service Co	Waterloo, Iowa	Maynard	J F Pritchard
Fort Bend Utilities Co	Near Land, Texas		A H Weth
Southwestern Public Serv Co	Roswell, N. M.	Roswell	
Minnesota Power & Light Co	Duluth, Minn.	Duluth	Ebasco Services
Southwestern Public Serv Co	Guymon, Okla.	Guymon	
Long Island Lighting Co	Glenwood Landing, N.Y.	Glenwood No. 2	Burns & Roe
Long Island Lighting Co	Glenwood Landing, N.Y.	Glenwood No. 2	Ebasco Services
Lynn Gas & Electric Co	Lynn, Mass.		Stone & Webster
Missouri Utilities Co	Poplar Bluff, Mo.	Poplar Bluff	Black & Veatch
Southwestern Public Serv Co	Denver City, Texas	Denver City	Gibbs & Hill
BELOW 400 PSI			
Central Power & Light Co	Corpus Christi, Texas	Nueces Bay	Sargent & Lundy
Southwestern Public Serv Co	Amarillo, Texas	East	
Public Serv Co of Okla	Hugo, Okla.	Hugo	
Southwestern Gas & Elec Co	Texarkana, Ark.	Texarkana	
Mount Carmel Pub Ut & Serv Co	Mt Carmel, Ill.	Mt Carmel	
CANADA			
New Brunswick Elec Power Comm	Chatham, N. B.	Chatham	
Nova Scotia Light & Power Co	Halifax, N. S.	Halifax	Montreal Engrg Co
New Brunswick Power Co	St John, N. B.	Dock St.	Montreal Engrg Co
Maritime Electric Co Lmtd	Charlottetown, P. E. I.	Sydney St.	Montreal Engrg Co
Saskatchewan Power Comm	Saskatoon, Sas.	Saskatoon	
Saskatchewan Power Comm	Estevan, Sas.	Estevan	H A Hanright

LIST PUBLISHED IN POWER, JUNE 1946

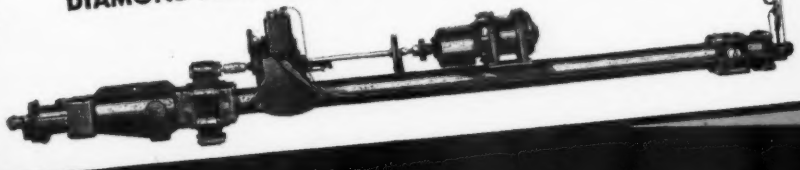
83.6%

OF THE SOOT BLOWERS FOR THESE PLANTS ARE DIAMOND SOOT BLOWERS

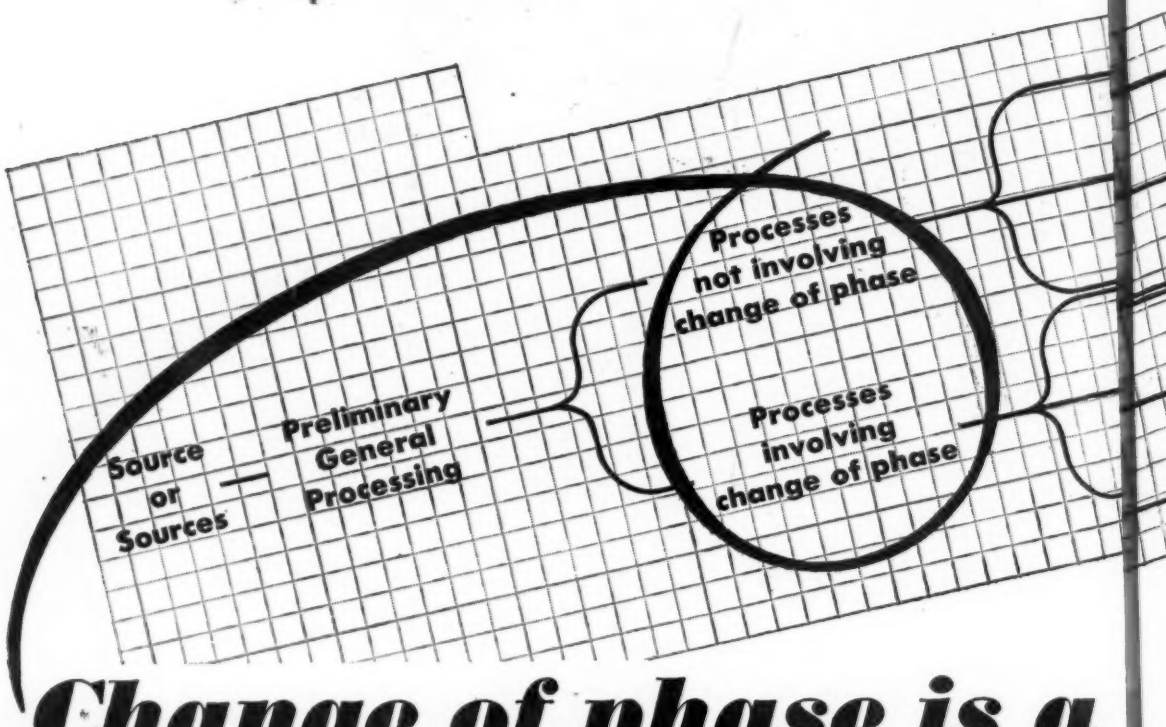
Significant to the engineer concerned with soot blowers is the overwhelming preference for Diamond Soot Blowers in the representative central stations listed here. The 83.6% includes all types of Diamond soot blower installations . . . from automatic sequential air (and/or steam) soot blower systems to manually operated individual blowers . . . depending upon the needs and preferences of the particular plant.

DIAMOND Model IK Long Retracting Soot Blowers

DIAMOND Telescopic Long Retracting Soot Blowers



DIAMOND POWER SPECIALTY CORP., DETROIT 31, MICH.
DIAMOND SPECIALTY LTD., WINDSOR, ONT.


Source or Sources
Preliminary General Processing
Processes not involving change of phase
Processes involving change of phase

Change of phase is a in problems

From the standpoint of water treatment, industrial uses of water fall into two major classes. One group includes those applications in which water is used as water for plant service, for industrial processes and for some types of cooling systems. The second covers those uses in which water *changes phase*, being converted into steam with subsequent condensation of the steam into water.

Each of these groups of uses presents its own special problems.

SERVICE AND PROCESS WATERS

In general, the problems which arise in connection with the first group of uses are comparatively simple. Service water may have to be purified; process waters may require additional softening, more complete removal of such substances as iron and manganese, or even complete demineralization; all water may require threshold treatment to prevent corrosion and scale in pipes. Since change of phase is not involved, problems in this field, while fully as urgent, are usually less complicated than those of the second group.

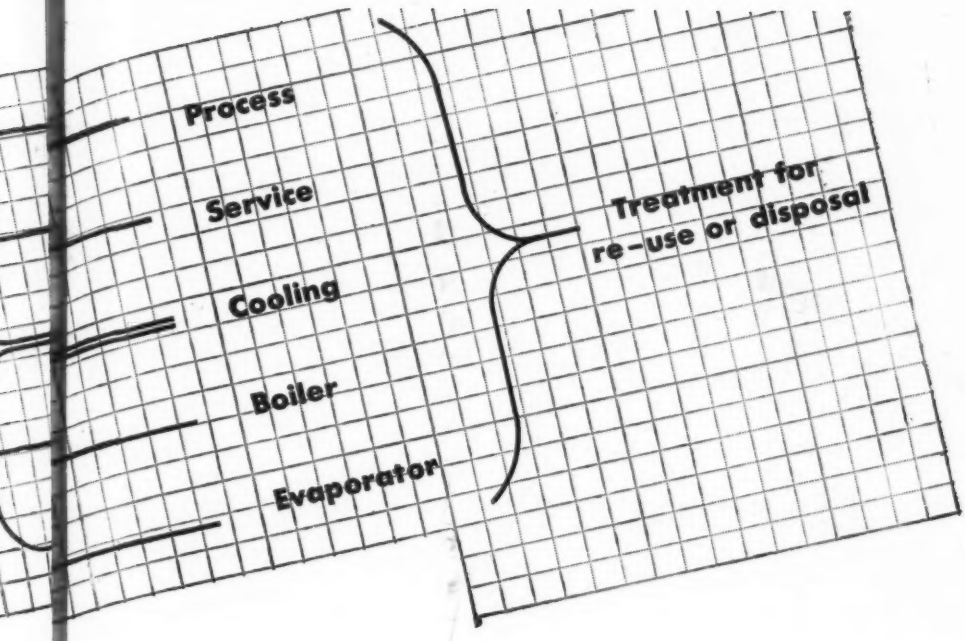
When, however, we deal with uses which involve evaporation and steam formation, particularly at high temperatures and pressures, the problems are more difficult, far more complex, and present an almost infinite variety of intricate cross relationships. Correct solution of these problems is imperative, for the life expectancy of boiler tubes depends directly on the proper water treatment and the care and precision with which prescribed procedures are carried out.

CHANGE OF PHASE BRINGS PROBLEMS

The very fact of evaporation means that the total quantity of impurities in the remaining water tends to increase, for make-up water is inevitably less pure than the steam it replaces. At high temperatures and ratings, the solubility relationships of such impurities are big factors in determining whether boiler tubes will continue to function or become clogged with deposit.

Chemical changes, too, can be expected. Relatively harmless sodium carbonate may form caustic soda—which may or may not be harmful depending on circumstances in any specific situation. CO_2 will be liberated in this process, and CO_2 carried over with steam will

HAGAN
HALL
BUROMIN
CALGON



factor of water treatment

accelerate corrosion wherever condensation occurs.

CONSTANTLY CHANGING CONDITIONS

Any treatment procedure which is set up must make provision for constantly changing conditions such as these. Typical procedures include pre-treatment of water before it enters the boiler, treatment within the boiler, and a definite program of blowdown. But—what type of pre-treatment? What treatment in the boiler? What blowdown schedule? What share of the total result is to be achieved by each part of the procedure?

Change of phase also brings with it the problem of preventing the carry-over of impurities in the steam. Some of these impurities may themselves vaporize and mix with the steam, or the carry-over may be physical. The answer may be mechanical, or it may be a matter of water treatment, or it may be a combination of both.

There is no stock answer to these problems and to the dozens of inter-related problems which arise in processes in which water is evaporated, or steam condensed. Hall Laboratories, however, not only understands these problems but knows their implications in terms of plant construction and operation—and plant personnel. Hall knows, too, that the answer must ultimately be in terms of dollars and cents.

ANSWERS FOR YOUR SPECIFIC PROBLEMS

Hall Laboratories is prepared to recommend procedures which, taking all factors into account represent the most economic and efficient solution *in your specific situation.*

Every problem concerning the use of water in industry comes within the scope of Hall Laboratories. Correspondence concerning such problems is invited.

Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

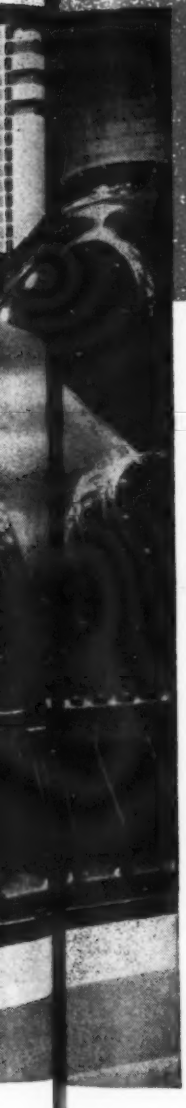
When human legs are used to generate power they get along without oil or grease . . . but the turbines that generate power today need oils designed to prevent rust, oxidation and foaming — *Texaco Regal Oils (R & O).*

"LEG POWER" NEEDS NO OIL OR GREASE . . .

Tune in . . .
TEXACO STAR THEATRE
presents the NEW
TONY MARTIN SHOW
every Sunday night.
See newspaper for
time and station.

TEXACO

but turbines must have SPECIAL OILS



TURBINES in service for years . . . and new ones going on the line . . . all benefit by lubrication with *Texaco Regal Oils (R & O)*. These are the world-famous Texaco Regal Oils *improved* by inhibitors against rust and oxidation, and specially processed to prevent foaming.

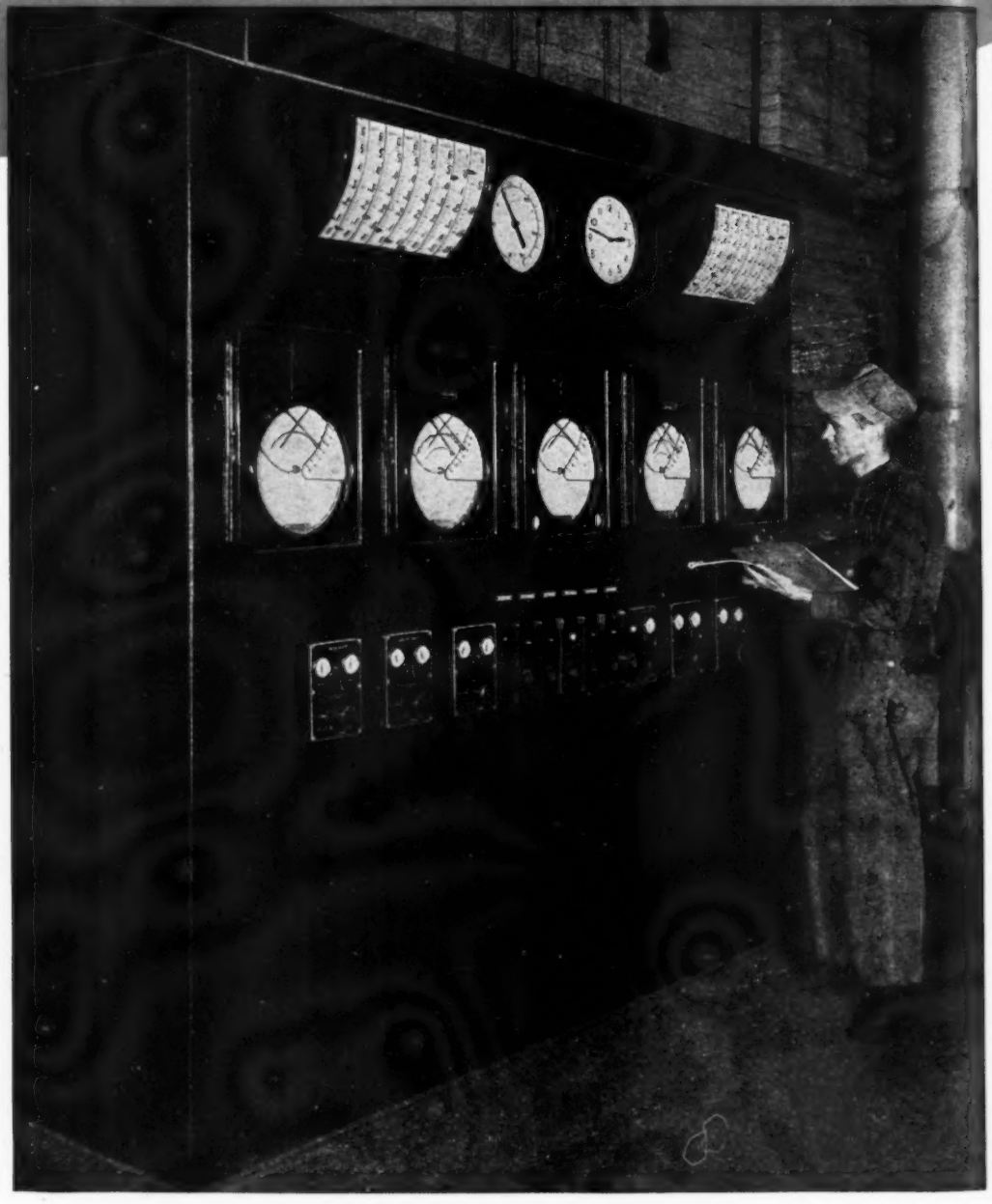
Texaco Regal Oils (R & O) free themselves rapidly of air and water and are especially efficient in keeping lubricating systems clean . . . preventing sludge and rust . . . assuring normal bearing temperatures and smooth, responsive governor action.

In addition, *Regal Oils (R & O)* give extra long service life. They meet the turbine oil specifications of all leading turbine manufacturers as well as the U. S. Navy.

Use *Regal Oils (R & O)* and other Texaco lubricants for power plants . . . plus Texaco Lubrication Engineering Service. Just contact the nearest of the more than 2500 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

REGAL OILS (R & O)
FOR ALL TURBINES

How to get A "SWEET" CONTRO



Control of two 65,000 lb. per hour boilers is based on the accurate measurements of these Bailey Meters at The White Motor Co., Cleveland, Ohio. Day to day evaporation runs consistently above the guarantee.

There's More to Boiler Controls Than Regulators

If you want a sweet running control for your boiler plant—look to more than bare regulators when you write your specifications. Here are some additional points to consider:

1 *Insist on controllable equipment*

Fans, dampers, pulverizers, stokers, burners, and other equipment must be adaptable to automatic control before any system can give truly satisfactory results.

2 *Control from all important variables*

Multiple element control systems which respond to all of the important variables, insure against costly disturbances in plant operation. They increase safety, decrease auxiliary power required, and reduce the storage capacity needed in heaters and boiler drums.

3 *Profit from the experience of others*

Steam plants similar to yours already are being operated at optimum performance by Bailey Boiler Control. Your dividends, from our experience in making thousands of boiler control installations, take the form of refinements in control application which insure trouble free operation. Over 8,000 boiler units have been equipped with Bailey Controls during the past ten years. These units range from 3,000 to 1,000,000 pounds per hour capacity and operate at pressures from 75 to 2,500 psi. They are fired by pulverized coal, stokers, oil, gas, mixed fuels and waste fuels.

4 *Operate control from accurate measurements*

A control system is no better than the measurements to which it responds. Bailey Controls are based on accurate measurements made by Bailey Meters.

5 *Consult Qualified Application Engineers*

Bailey Engineers are qualified by training and experience to consult with you on both the theoretical and practical aspects of your boiler control problems. These specialists are conveniently located in over 30 industrial areas throughout the United States and Canada.

Details for Your Problems

If you want details write for a copy of Bulletin 15-D or ask a Bailey Engineer to call.

BAILEY METER COMPANY

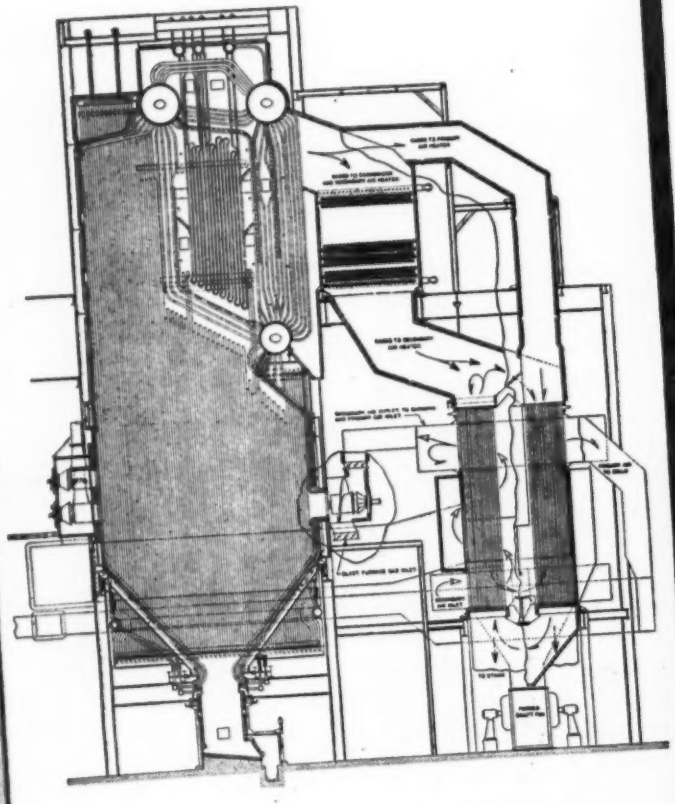
1036 IVANHOE ROAD • • • CLEVELAND 10, OHIO

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

A-98

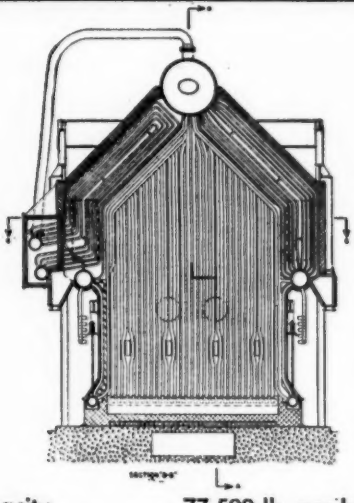
The steam generating capacity



Steam Capacity . . . 500,000 lb. per hour
Efficiency . . . . . 88.50 per cent

Every dollar you spend for fuel is a financial transaction with a potential return of so much steam.

There is just so much heat available in the fuel you buy. The problem is to transfer as much of this heat into steam as modern engineering is capable of doing.



Steam Capacity . . . 77,500 lb. per hour
Efficiency . . . . . 85 per cent

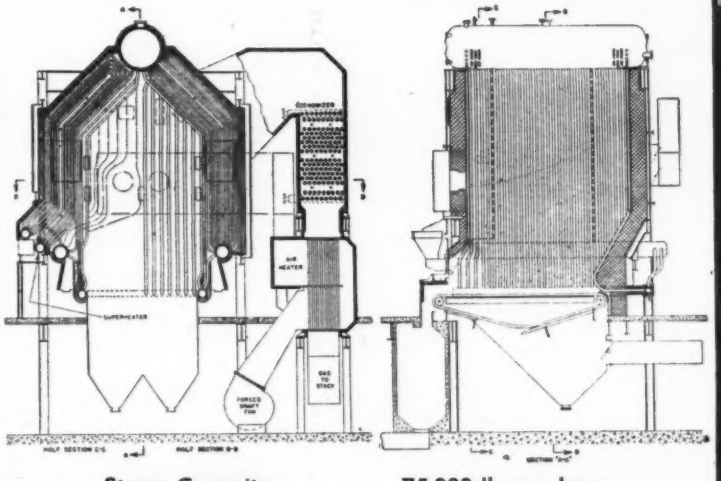
FW FOSTER

# of your Dollar

Look at the table and see how near Foster Wheeler can bring you toward realizing a dollar's worth of steam for a dollar's worth of fuel. Then look to a leader when you are ready to install a new steam generating unit in your plant.

Foster Wheeler Corporation
165 Broadway, New York 6, New York.

NUMBER OF UNITS	CAPACITY LB. PER HOUR	PER CENT EFFICIENCY
2	640,000	86.04
1	400,000	83.07 (gas) 87.55 (oil)
1	375,000	85.18
1	325,000	85.11
4	216,000	84.
1	300,000	86.89
2	300,000	84.81
1	500,000	88.50
1	385,000	88.40
2	250,000	87.05
1	250,000	83.80
2	215,000	84.24
4	120,000	86.88
2	175,000	82.17
1	77,500	85.



Steam Capacity . . . 75,000 lb. per hour
Efficiency . . . . . 85 per cent

WHEELER FW

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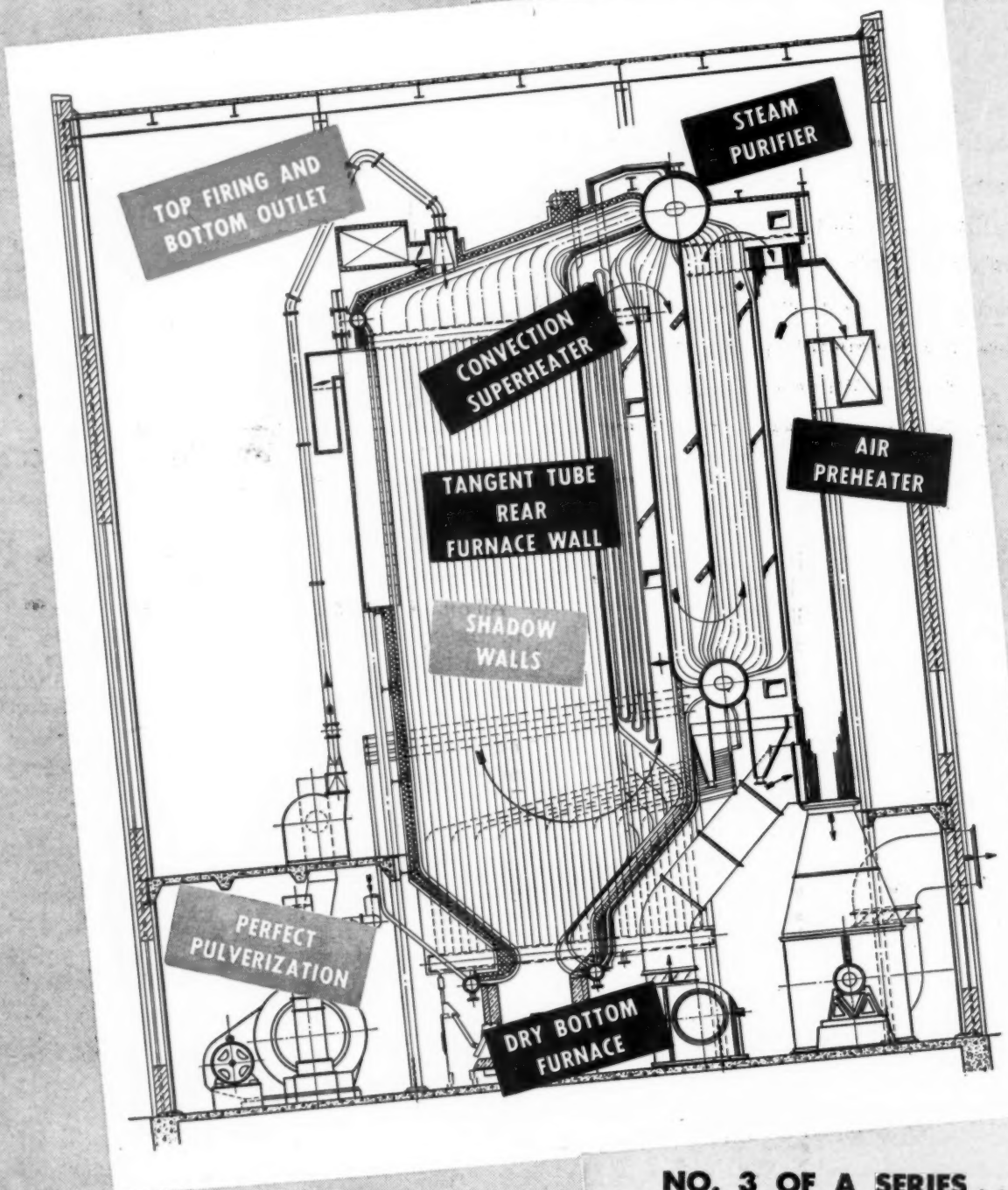
KVS ENGINEERED



NO. 3 OF A SERIES . . .
See APRIL "POWER" *for description of* PULVERIZATION

COMBUSTION...

results in higher furnace temperature on all grades of coal handled...

—when combined with the

KENNEDY COAL BURNER

The Kennedy Coal Burner embodies all desirable features — low first cost, low maintenance, and high availability.

This burner may be either of the Rotary or the Vortex type. In both these types of burner KVS has engineered the following advantages:

— high turbulence, completing the carburization of the coal . . .

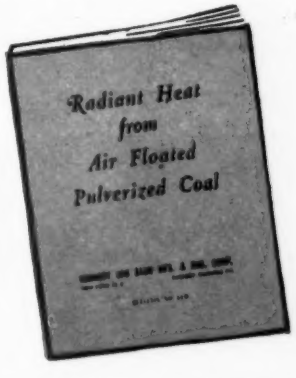
— with top firing, positive furnace pressure maintains an extremely high temperature, and anthracite coal is readily burned without the usual refractory-covered tube area necessary with other types of burners and firing . . .

Combustion is completed in a relatively short distance from the burner, producing high-temperature luminous gases to radiate on the furnace walls, resulting in high evaporation in the furnace area . . .

— all carbon particles are completely burned, and when gases turn at the bottom of the furnace to enter the superheater area the ash, (which is the residue) is dropped into the ash hopper . . .

— the carbon loss is controlled by (1) fineness of pulverization, (2) turbulence at burner and (3) length of flame.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.



KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance-proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

KENNEDY-VAN SAUN · QUALITY · SERVICE · Kennedy Products · NEW YORK · USA · MFG. & ENG. CORP.

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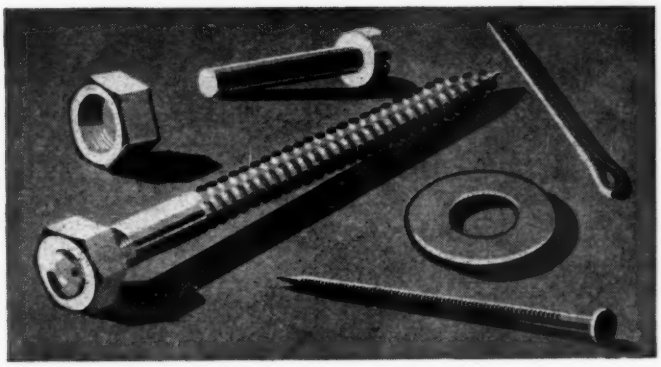
Remember

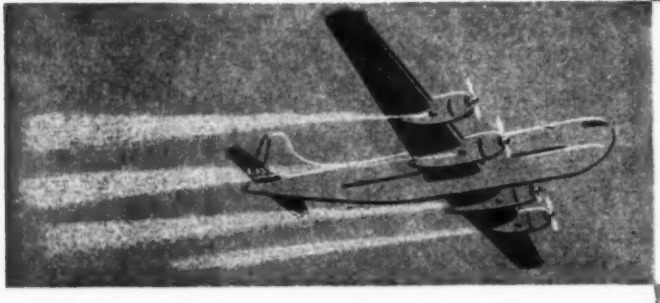
MONEL* for these...



and *forget* worries like these...

OVERSTRESSING

You get an extra margin of safety when you use Monel nuts, bolts and screws. For, tests show that Monel has 45% higher strength... 35% more ductility than ordinary carbon steel. This combination enables Monel fastenings to take more punishment from sudden shock, twisting, and excessive loads.

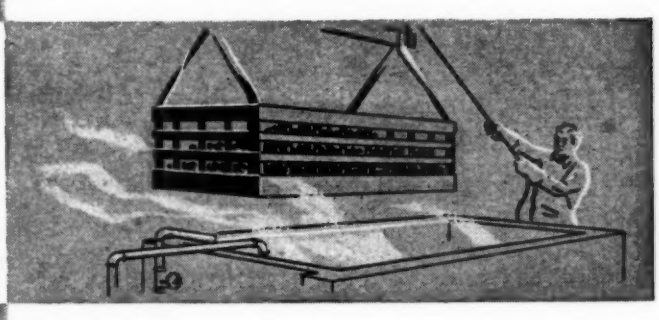


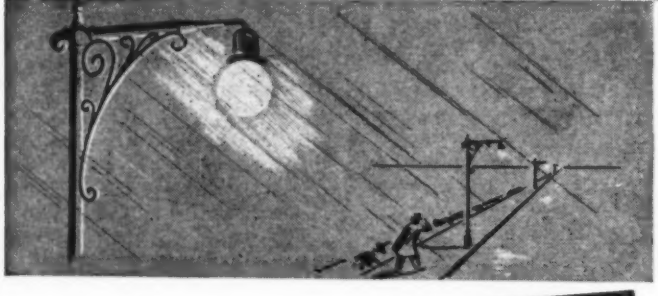
HEAT...OR SUB-ZERO COLD

Use Monel wherever fastenings must withstand high heat without burning or stretching... or wherever fastenings must resist low temperatures without snapping apart. For, Monel becomes steadily stronger, with no loss of toughness, right down to 423 degrees below zero F.

CORROSION

Monel fastenings resist most acids, caustics, salts, food products and fumes. That is why they can stand up where corrosion destroys ordinary fastenings.





RUST

Fastenings of Monel cannot rust or dezincify... never bind or freeze. They won't discolor fine fabrics or finishes.

Where to get MONEL fastenings:

If your regular supplier cannot furnish the Monel fastenings you want immediately, get in touch with your nearest source of supply listed below.

EAGLE METALS CO., Portland, Seattle
HENDRIE & BOLTHOFF M&S CO., Denver
METAL GOODS CORPORATION, Dallas, Houston, New Orleans, Tulsa
PACIFIC METALS COMPANY, LTD., Los Angeles, San Francisco
STEEL SALES CORP., Chicago, Detroit, Indianapolis, Milwaukee, Minneapolis, St. Louis
J. M. TULL METAL & SUPPLY CO., Atlanta
WHITEHEAD METAL PRODUCTS COMPANY, INC., Baltimore, Boston, Buffalo, Newark, New York, Philadelphia, Syracuse, New Haven
WILLIAMS AND COMPANY, INC., Cincinnati, Cleveland, Columbus, Pittsburgh, Toledo

You'll find Monel fastenings available for every need. You can have Monel screws, bolts, nuts, screws, washers, rivets, nails, pins... and many special fastenings. Tell us your fastening problem and we'll be glad to send you samples of the Monel fastenings you require.

*Reg. U. S. Pat. Off.

INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC., *67 WALL STREET, NEW YORK 5, N. Y.*

A COMPACT, PORTABLE SET FOR MEASURING A-C POWER

Here's a new indicating device created by General Electric to meet industry's need for a small, lightweight, low-cost analyzer. Employing an advanced principle of instrument design, it permits all readings to be made on a single scale. Easy to operate and having a wide range of usefulness, this versatile instrument requires only a few simple, convenient connections.

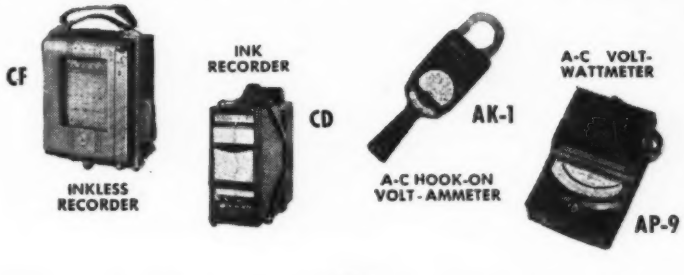
5 INSTRUMENTS IN ONE

Besides serving as a standard 0-2.5/5-amp ammeter and a 0-150/300/600-v voltmeter—or with conventional instrument transformers to extend the range—this instrument can be used, with the aid of the calculator provided, to determine quickly and easily watts, vars, and power factor for load surveys, induction motor tests, reactive-power studies, and power-factor improvement programs.

This handy instrument comes complete with instruction card, calculator, and flexible voltage leads, all enclosed in a sturdy carrying case. Total weight only five pounds. For additional information, write for Bulletin GEA-4784. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

PRICE $97.50

THIS LINE OF GENERAL ELECTRIC PORTABLES INCLUDES:



GENERAL ELECTRIC

602-108

CLIP AND MAIL THIS COUPON TODAY

Yes, I need one of your new A-C Load Visualizer sets immediately. Enclosed is my order, with check for $97.50. Ship express collect.

Name .....

Company .....

Address .....

City ..... State .....

Mail to: General Electric Company, Instrument Section, 40 Federal Street, West Lynn, Mass.

Double Check ON

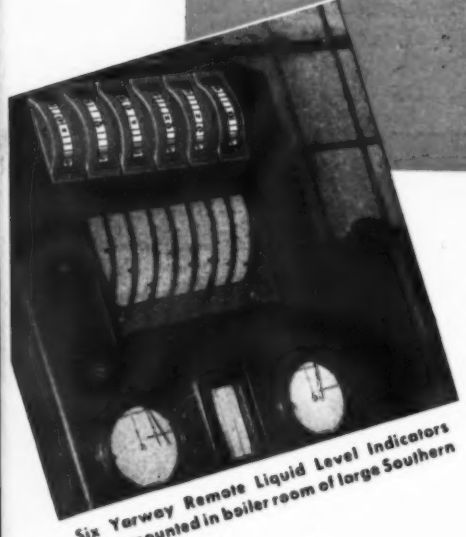
Here's an instrument that brings boiler water level indication right down to eye level, on the instrument panel or other convenient location—a perfect *check* on hard-to-see overhead gages.

Yarway's Remote Liquid Level Indicator is always accurate because it is operated by the boiler water itself—by the pressure differential between a constant head of water and the varying head in the boiler drum. Action is instant, constant, frictionless. *There are no stuffing boxes.* Indicating mechanism is never under pressure . . . it is perfectly balanced on jewelled bearings outside of the pressure chamber.

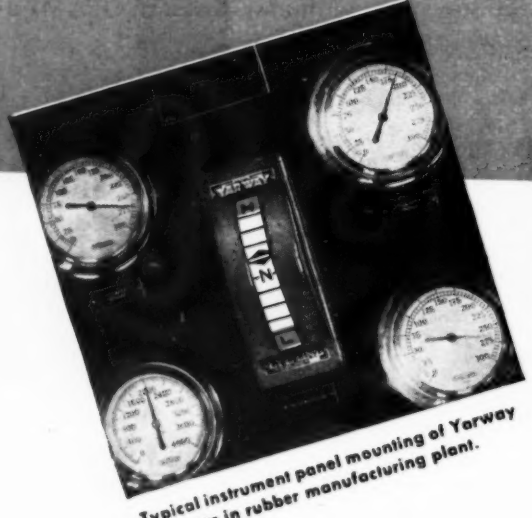
From coast to coast the Yarway Indicator is meeting with enthusiastic approval. As one prominent user said, "If I couldn't get another one like it, I wouldn't sell the one I have for many times its cost!"

More than 2,500 have already been bought for indicating boiler water level, feed heater water level, and superheater pressure differential. For complete description of operating details, write for Bulletin WG-1821.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.



Six Yarway Remote Liquid Level Indicators flush-mounted in boiler room of large Southern textile mill.

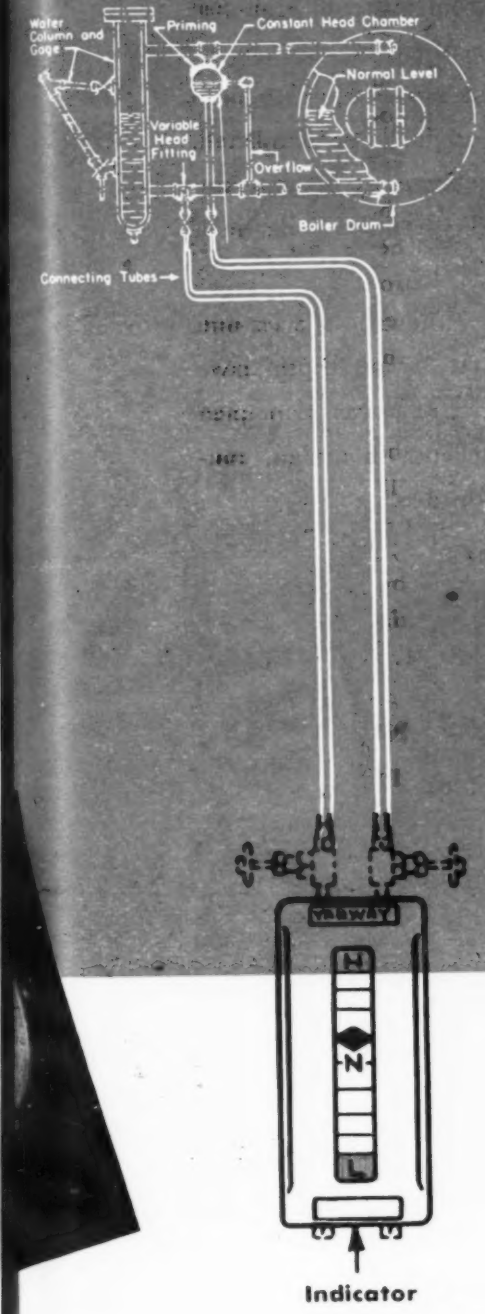


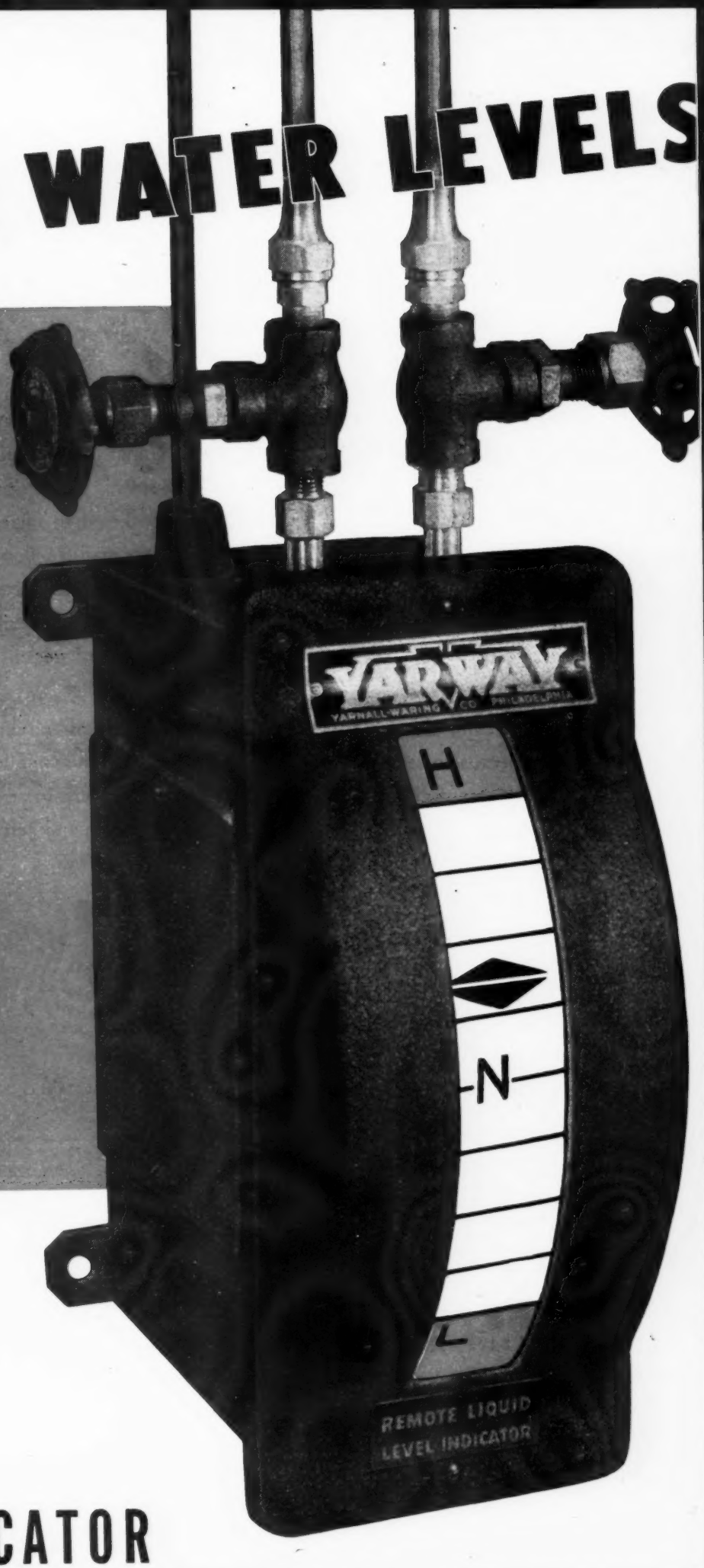
Typical instrument panel mounting of Yarway Indicator in rubber manufacturing plant.

One of two Yarway Indicators mounted on end of instrument panel in boiler room of Western utility.

YARWAY REMOTE LIQUID

BOILER WATER LEVELS





LEVEL INDICATOR

more steam at lower

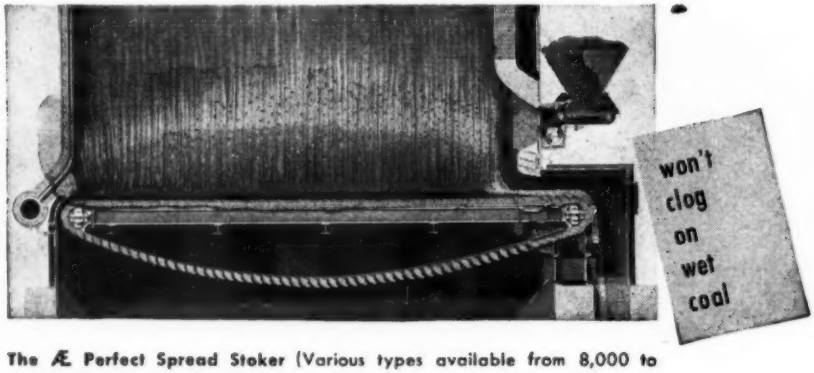
First it was the War . . . then Reconversion . . . shortages . . . strikes . . . transportation. Whatever the reason . . . if you're tired of waiting for more steam at lower cost, fed up with delivery promises, tired of coddling over-age burning units and feeding them a daily diet of high priced coal . . . here's help for you—now!

QUICK STOKER DELIVERIES

We are prepared to make fast delivery on both Æ Taylor and Æ Perfect Spread Stokers, because we have greatly expanded our stoker manufacturing area, stock piles and capacity.

There's no longer any need to wait for months for relief from wasteful, high-cost steam production. Most boilers can be stokered to increase capacity and to burn low grade fuel not originally contemplated. Improved efficiency, increased capacity and greater fuel flexibility can be yours in a matter of weeks.

Both Æ Stokers burn various sizes and grades of bituminous coal. Both have earned the confidence of power plant men everywhere for excellence in design, construction and performance.



The Æ Perfect Spread Stoker (Various types available from 8,000 to 400,000 lbs. of steam per hour)

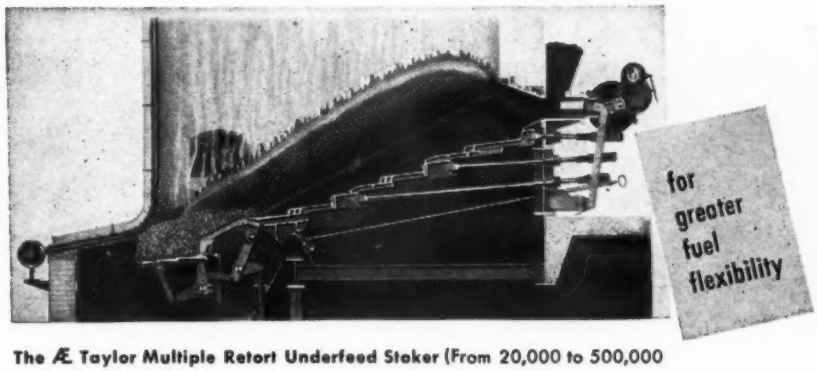
AMERICAN ENGINEERING COMPANY
2400 ARAMINGO AVENUE • PHILADELPHIA 25, PENNA.

cost—but quick

ENGINEERING SERVICE

We offer you the "know-how" of our Engineering Department, backed by forty years of combustion engineering experience. Call in our nearest representative and he will go into action for you today. We will recommend an improvement program and if you approve, will send a stoker expert to your plant. He will make on-the-spot layouts, and upon your approval, fabrication will start. No red tape, no lengthy correspondence.

Take advantage of this opportunity by acting now. Our manufacturing schedules may be filled beyond capacity if you delay. Your nearest Æ representative is listed on this page.



The Æ Taylor Multiple Retort Underfeed Stoker (From 20,000 to 500,000 lbs. of steam per hour)

OTHER Æ PRODUCTS: *Lo-Hed Hoists, Marine Deck Auxiliaries, Hele-Shaw Fluid Power*

These Æ Representatives Will Help You . . .
Call, write or wire the representative nearest you today!

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Robert T. Forbes
201 Devonshire St.

BUFFALO 14, N. Y.
The Schall Co.
P.O. Box 76—Station H

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American Engineering Co.
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Arno N. Dietze
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342 Madison Ave.

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Fuchs Machinery & Supply Co.
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Paul J. Stein
2375 Bensonia Ave.

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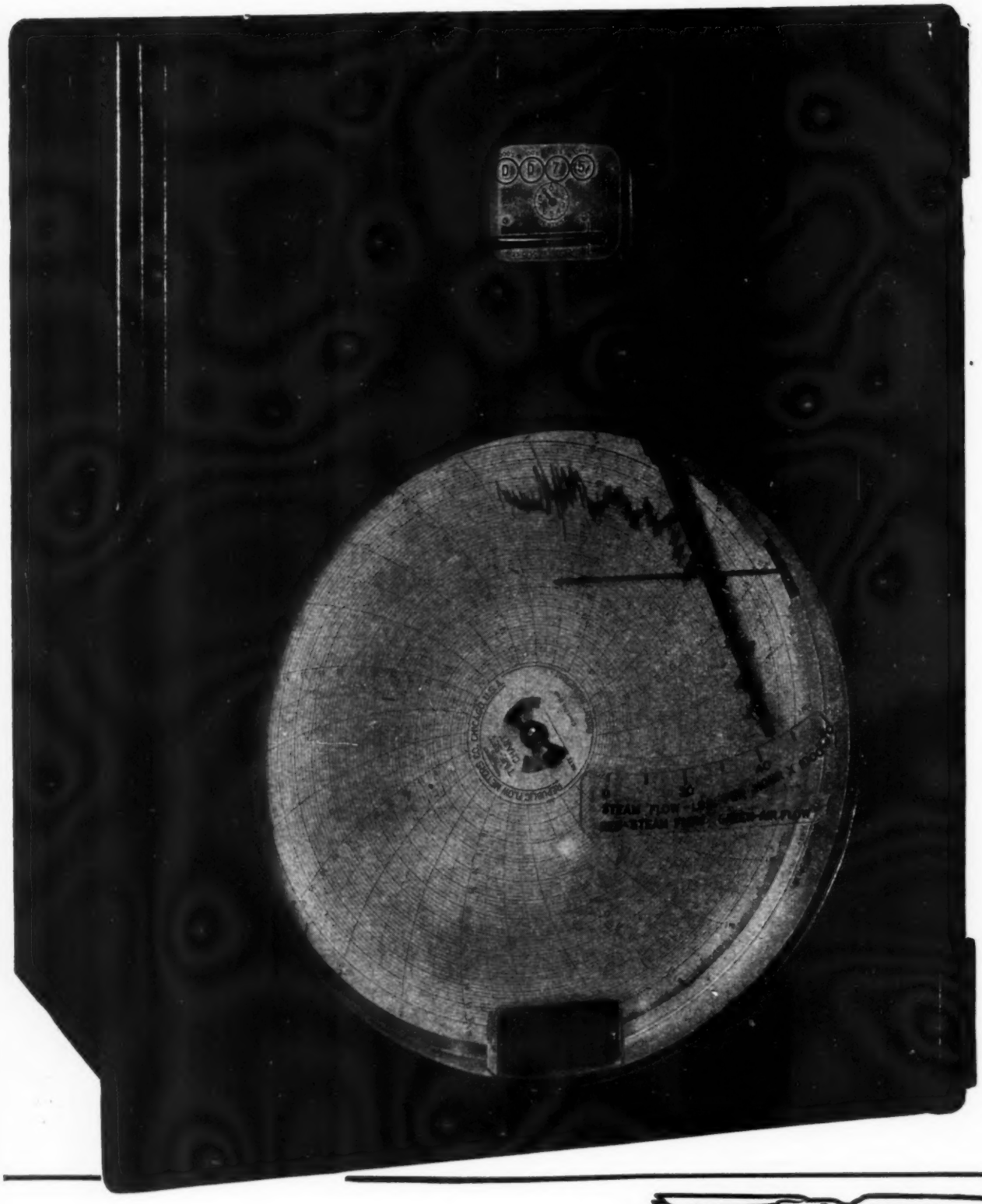
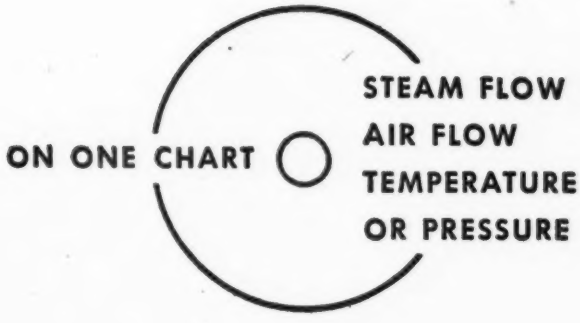
4030 Chouteau Ave.

Write for Data on the



REPUBLIC
INSTRUMENTS
AND CONTROLS

Republic Boiler Meter



● The new Republic Boiler Meter provides, in one instrument and on one chart, all the essential information concerning boiler performance regardless of the size or type of boiler, kind of fuel or method of firing.

The meter indicates, records, and integrates steam flow from the boiler and records rate of air flow for combustion. When the correct amount of air for maximum combustion efficiency is being supplied the air flow pen will record coincident with the steam flow pen, regardless of the load being carried by the boiler.

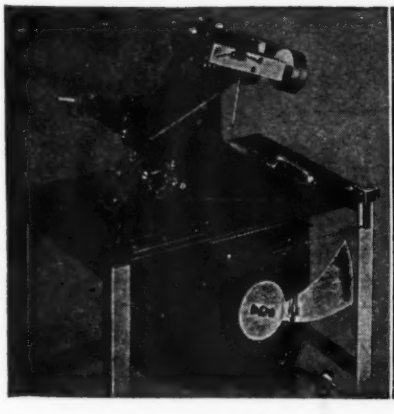
A third pen recording flue gas temperature (or steam pressure) can be added thereby providing the operator with complete information, on one 12-inch chart, relative to the performance of the boiler at any given time.

The Republic Boiler Meter is primarily a boiler operating guide. The two records, steam flow in red and relative air flow in blue, tell the operator instantly whether correct combustion and furnace conditions exist, thereby enabling him to correct faulty conditions when they occur.

The Republic Boiler Meter consists of a standard Republic electric steam flow recorder and integrator and an oil sealed, bell type air flow element.

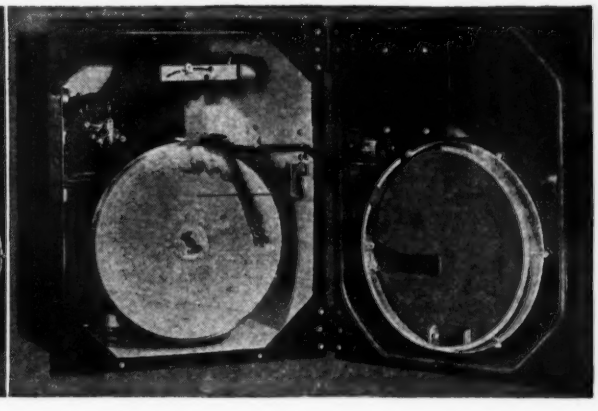
The air flow element consists of an oil sealed bell in a sealed chamber. The motion of the bell is transmitted through a diaphragm seal. This arrangement permits the use of a single bell—the high pressure being applied to the top of the bell and the low pressure under the bell. This arrangement also excludes air and dirt from the oil. The motion of the bell is transmitted to a cam system which extracts the square root, or when adjusted for a particular installation, compensates for chimney action and variable excess air requirements. The air flow pen is attached to the cam system with an adjustable linkage which permits changing the steam flow air flow ratio as conditions may require.

The entire operating mechanism is housed in a rugged steel case and can be easily removed as a single unit by merely loosening two anchor bolts and disconnecting the two air connections. The meter may be either wall mounted or flush mounted on a steel panel. *Write for Bulletin No. 420.*



Meter assembled as one unit on rack ready for calibration.

Meter assembly can be easily removed from the case.



Meter with door open showing accessibility of all adjustments and working parts.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago 47, Illinois

7 TONS OF COAL

THE OHIO SEWER PIPE COMPANY
UHRICHSVILLE, OHIO

Phones:
UHRICHSVILLE 100

Manufacturers
SEWER PIPE · FLUE LINING
WALL COPING

Uhrichsville, Ohio
February 7, 1947

Iron Fireman Manufacturing Co.,
Cleveland, Ohio

Gentlemen:

We have four return tubular boilers and find that after installing Iron Fireman stokers, three boilers will do the same work that formerly required four, which gives us one spare boiler for emergency use.

Before your stokers were installed, it required 20 to 22 tons of coal per day to produce the same results we now get from 15.941 tons. (These figures taken for the month of January 1947, which is considered a full production month.) This represents a saving of over 7 tons per day.

This also means that our engineers are a satisfied group with no ashes to remove from the rear of the boilers, which has lessened their work materially.

Our last stoker was installed Dec. 24th, 1946, and on our last inspection we were complimented very highly by the inspector who advised us that our power plant was one of the finest that he has had the pleasure of visiting. We would be glad to show our installation at any time to anyone interested in stoker equipment, and we cannot speak too highly for the service we have had since your stokers were installed.

Very truly yours,

The Ohio Sewer Pipe Co.

By Walter Dawson Supt

THREE BOILERS DO THE WORK OF FOUR

SAVES OVER 7 TONS OF COAL DAILY

ENGINEERS WORK LESSENED

Find out how you can save . . .

Write for free illustrated booklet, "The Iron Fireman Pneumatic Spreader Stoker" containing full descriptions, operating data, etc., with layouts and photos of 10 actual installations.

Boiler room survey, without obligation, will tell you what Iron Fireman stokers

HEAVY DUTY
AUTOMATIC
COAL STOKER

IRON

SAVED EACH DAY

by Ohio Sewer Pipe Company with Iron Fireman Stokers

Boiler room of the Ohio Sewer Pipe Co., Uhrichsville, Ohio. Iron Fireman Pneumatic Spreader stokers have materially reduced steam costs.

No manual fuel handling. The pneumatic conveying of coal to the furnace eliminates the excessive labor necessary in manual fuel handling. The coal is pneumatically conveyed from the main coal bunker at a uniform rate. The conveying medium is a mixture of air and hot furnace gases. The entire fuel conveying system is simple and easily accessible for inspection or adjustment.

Instant Responsiveness. Iron Fireman's instant responsiveness to load variations, and its automatic continuous control of the fuel-air ratio makes the Iron Fireman a great fuel saver.

Universal Adaptability. Because of its simple method of firing and coal conveying, the Iron Fireman Pneumatic Spreader stoker has almost unlimited adaptability to existing boiler room layouts without costly remodeling.

Low Maintenance. Maintenance costs are remarkably low because no moving stoker parts are subject to high furnace temperatures and all mechanism is easily accessible.

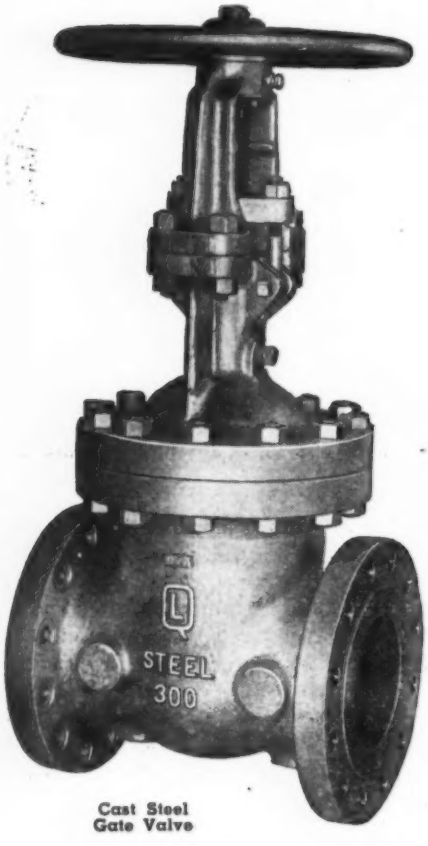
Clear Boiler Front. No hopper or stoker mechanism is attached to the boiler front, keeping the fire doors clear for fuel bed observation and fire cleaning.

can accomplish in your plant. Iron Fireman's nation-wide engineering, sales and service organization has had experience with every size and type of firing job. Address: Iron Fireman Mfg. Company, 3103 West 106th Street, Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada.

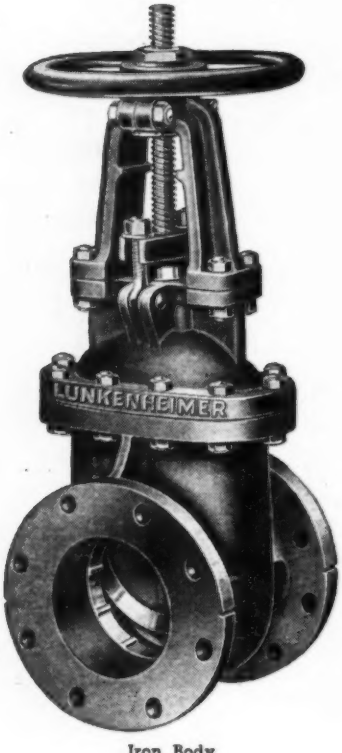
FIREMAN

FOR POWER PROCESSING AND HEATING

TIGHT VALVES ...REDUCE

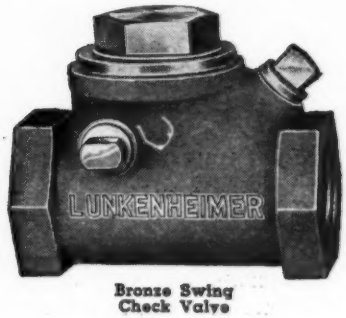


Cast Steel
Gate Valve



Iron Body
Gate Valve

Swing Check Valve
With Renewable
Bronze Seat and Disc



Bronze Swing
Check Valve

See Your Lunkenheimer Distributor For Better Valve Service.

Lunkenheimer Distributors are located in principal industrial centers. There is one near you, fully equipped and ready at all times to assist with your valve maintenance, repair and operation (MRO) problems.

Ask for Lunkenheimer chart showing costs of air, steam and water valve leakage.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.;
BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

SPEED PRODUCTION
MAINTENANCE COSTS

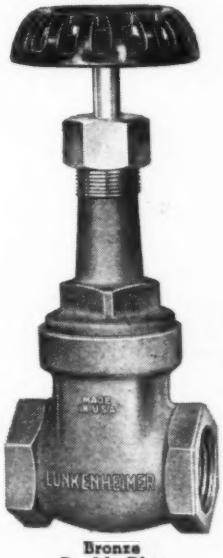
LUNKENHEIMER VALVES STAY TIGHT With LESS CARE

No business can afford wasteful, costly, production-lowering valve leakage. That's why it's always *good* business to maintain a regular check on valves, to make sure they are *tight* and in proper working order . . . . Maintenance men the nation over prefer Lunkenheimer Valves. They know from experience that these *quality-built* valves serve longer and better on the job — are easier to keep tight with a minimum of time, labor, and expense.

THE LUNKENHEIMER CO.
"QUALITY"

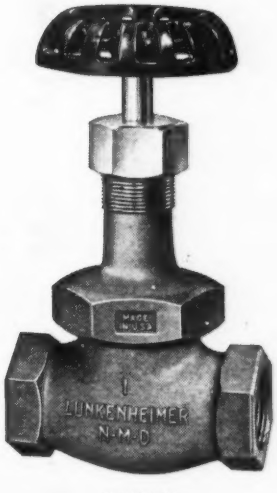
CINCINNATI 14, OHIO, U. S. A.

NEW YORK 13 • CHICAGO 6 • BOSTON 10 • PHILADELPHIA 7 • EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

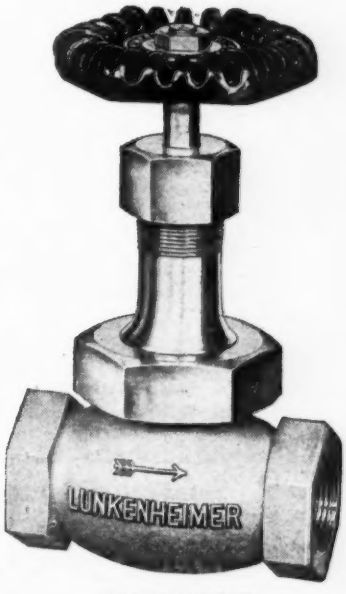


Bronze Double Disc Gate Valve

"King-clip" Gate Valve



"N-M-D" Globe Valve

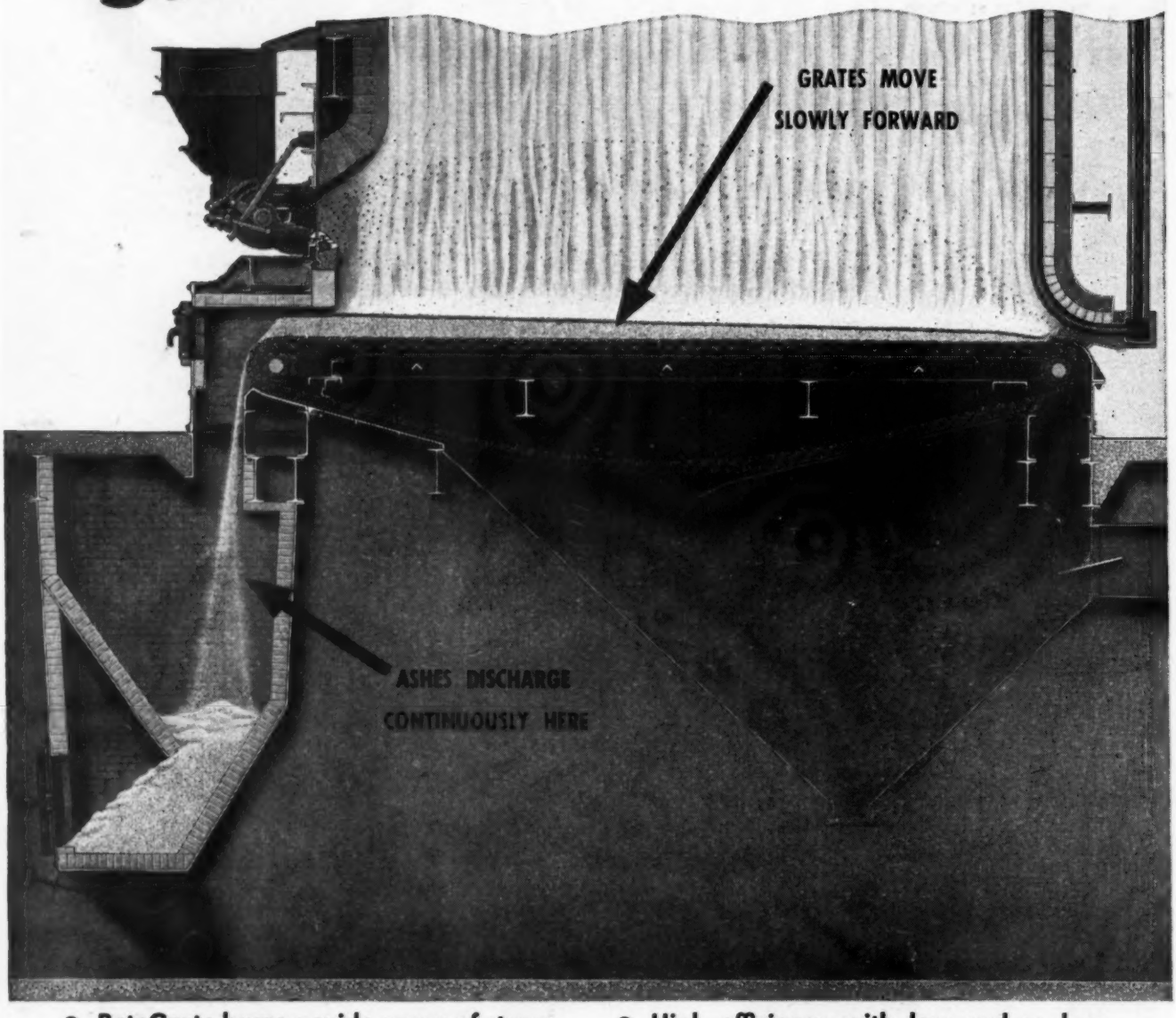


"Renewo Globe" Valve

LUNKENHEIMER VALVES

DETROIT ROTOGRATE STOKERS

Investigate this spreader stoker, with *Forward Moving Grates* that discharge the ash at the front and maintain uniform fuel bed conditions at all capacities. The movement of the grates is accurately proportioned to the fuel feed. Both are under full automatic control, with manual adjustments provided. Thoroughly tried and tested. Adopted by many Public Utilities and Industrial Plants.

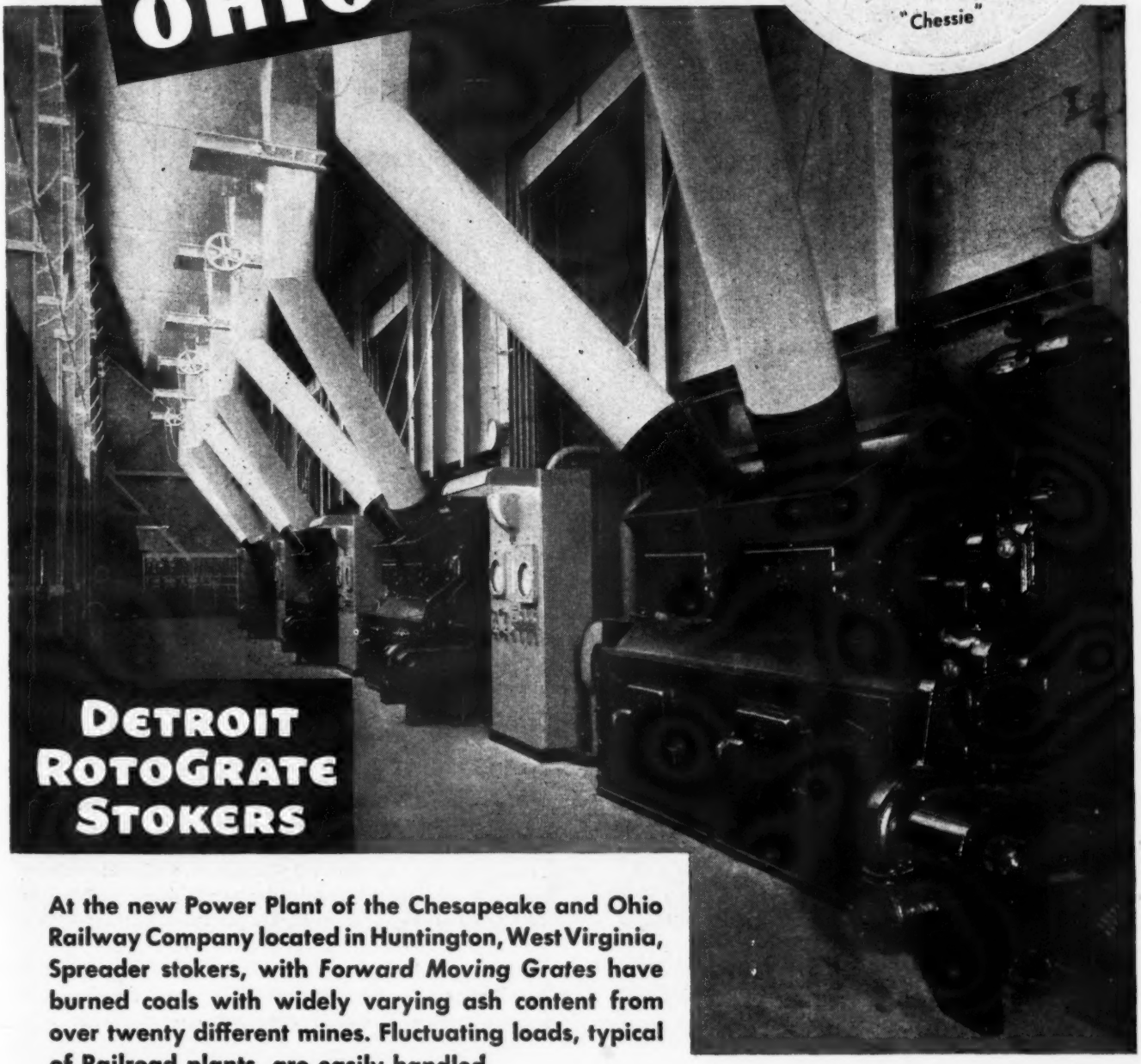


- **RotoGrate burns a wide range of steam coal without special preparation at *high burning rates.***
  - **Bituminous Coal**
  - **Semi-Bituminous Coal**
  - **Lignite**
  - **All sizes up to 1¼ inch screenings**
- **High efficiency with low carbon loss.**
- **Requires little power for operation.**
- **High availability with extremely low maintenance.**
- **Quickly responsive to changes in load.**
- **Preheated air successfully used without slagging or clinker difficulties.**

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Mich. • Works at Monroe, Mich.
District Offices in Principal Cities • Built in Canada at London, Ontario

CHESAPEAKE AND OHIO LINES



DETROIT ROTOGRATE STOKERS

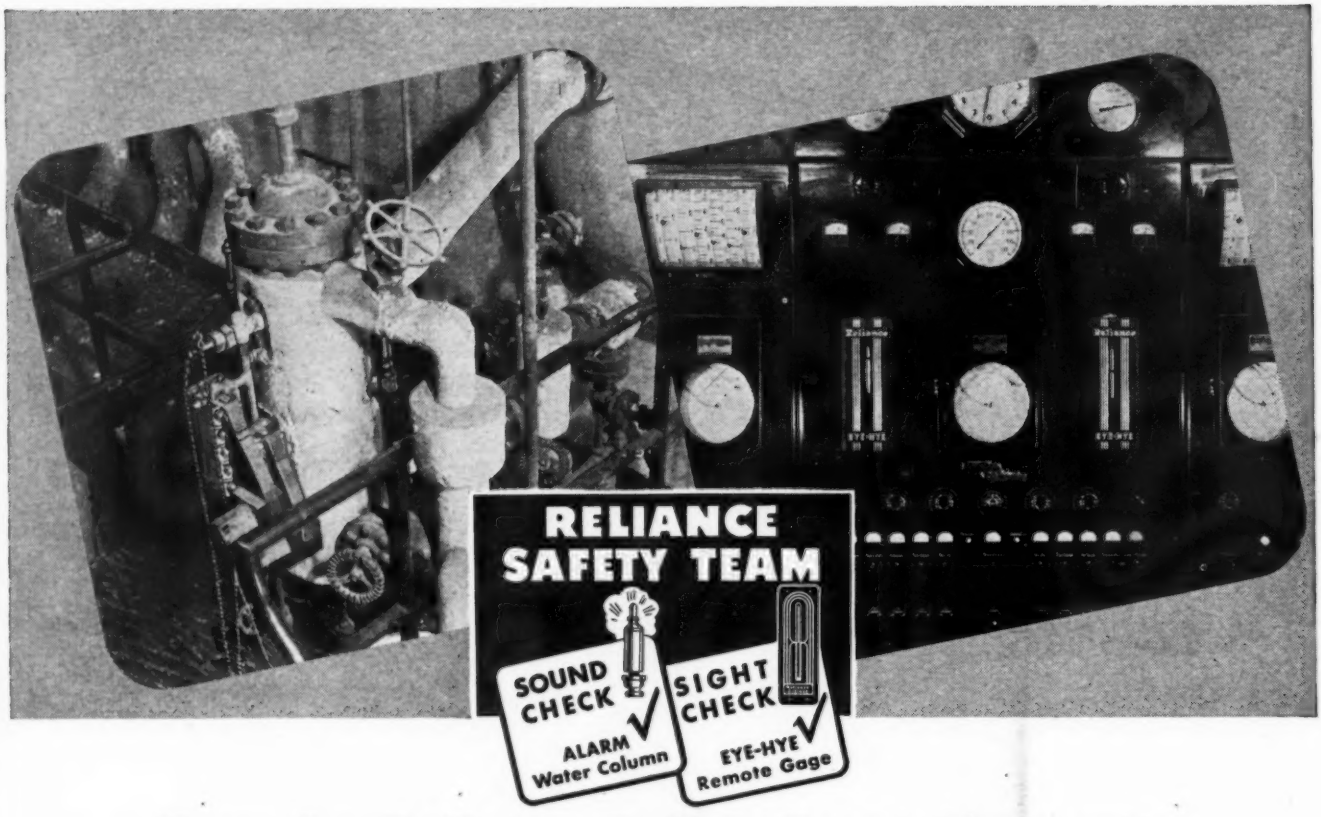
At the new Power Plant of the Chesapeake and Ohio Railway Company located in Huntington, West Virginia, Spreader stokers, with *Forward Moving Grates* have burned coals with widely varying ash content from over twenty different mines. Fluctuating loads, typical of Railroad plants, are easily handled.

Investigate the RotoGrate.

Firing Aisle — New Power Plant Chesapeake and Ohio Railway Co. Huntington, West Virginia

DETROIT STOKER COMPANY

Fifth Floor, General Motors Building, Detroit, Mich. • Works at Monroe, Mich.
District Offices in Principal Cities • Built in Canada at London, Ontario



How the Reliance Safety Team gives you

Double Supervision

of your important Boiler Water Levels

● Prevent boiler outage and expensive water level accidents by having *adequate* boiler water supervision — so easy to obtain with the Reliance Safety Team — ALARM Water Column and EYE-HYE Remote Reading Water Level Indicator. Save your operators hours of time, thousands of steps in their vital job of checking the "life blood of the boilers."

Reliance ALARM Water Column

The ALARM is your reliable SOUND check. Standing guard at boiler drum, its sensitive mechanism responds instantly to dangerously low or high water levels — warns boiler-room men by shrill whistle or electric signal. Its few working parts, its rugged construction — much heavier than required per pressure rating — assure trouble-free operation and a life as long as the boiler's. Reliance ALARMS are made for all types of boilers, all working steam pressures up to 900 pounds. Reliance High Pressure Water Columns are available for pressures to 2000 pounds without Alarms.

EYE-HYE Remote Reading Gage

The modern SIGHT check for water levels is the EYE-HYE. While the gage at the water column cannot be dispensed with, EYE-HYE is a convenient auxiliary that brings the reading down to an eye-level position, on wall or instrument panel. Is accepted in some codes as the *second* gage where two gages are required on higher pressures. Positive hydrostatic operation — as simple as the usual water gage. Has no moving parts. Shows exact reading in a brilliant illuminated green column — can be seen many feet away. Practically no upkeep expense. Models for any pressure, up to 2000 pounds.

BOILER SAFETY DEVICES since 1884

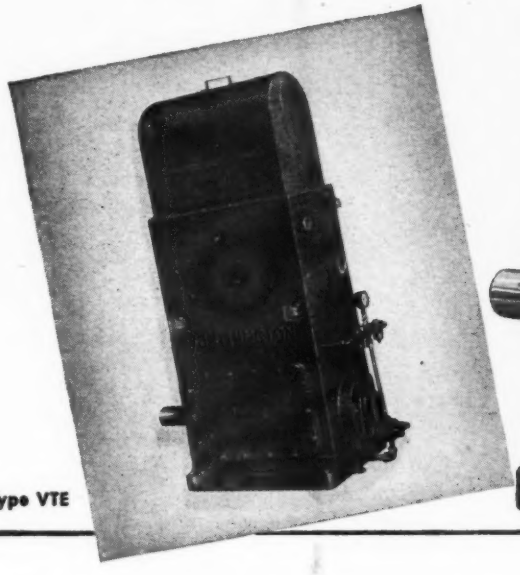
Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

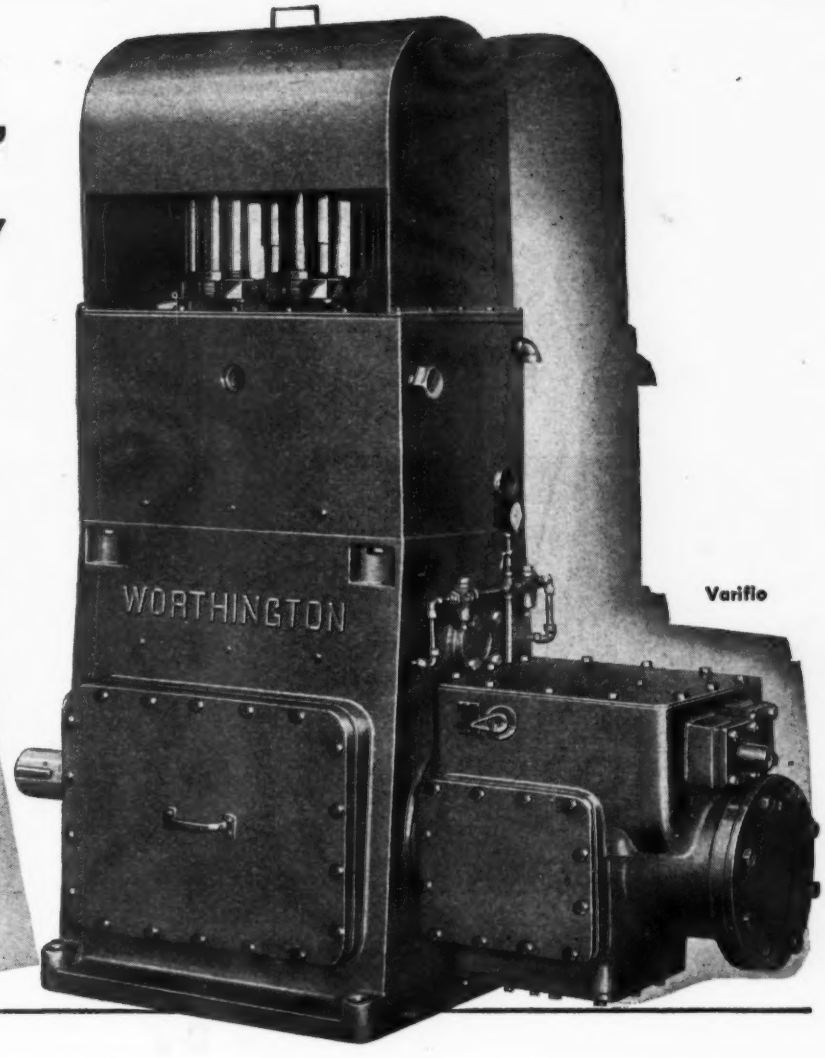
"PUTTING THE PRESSURE ON"

Smoothly . . . Exactly ...Automatically

Here's stepped-up efficiency for boiler feed and many other high pressure services!



Type VTE



Variflo

Positive, Accurate Capacity-Control

Operating at constant speed, Worthington Variflo Triplex Pumps regulate capacity by a simple, rugged eccentric which adjusts the plunger stroke to any degree from zero to 100%. Variation is completely *stepless and automatic*, with smooth, positive action that saves power over the entire capacity range.

Type VTE

Except for the crankshaft elements, the simple, compact, accessible design of Worthington Type VTE Triplex Pumps is identical with the Variflo's. Where variable capacity is not required, they perform with the same high dependability that proves *there's more worth in Worthington.*

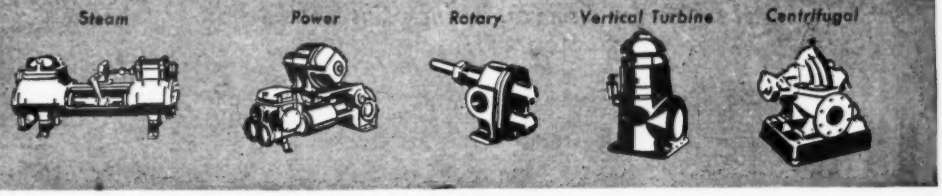
Constant Speed — Constant Savings

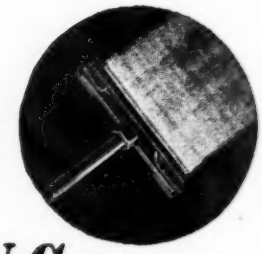
In Worthington Variflo and VTE Pumps the mechanical superiority and money-saving advantages of constant speed design have been developed to their fullest. Available in a complete range of sizes up to 165 gpm, in single units. Write for bulletins to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.*

WORTHINGTON

P7-1

THE WORLD'S LARGEST MANUFACTURER OF PUMPS





FLAME-PRIMING smooths

Flame-priming is a fast, easy, inexpensive way to prepare any metal surface for a smooth, lasting paint coat.

LINDE OXYGEN • UNION CARBIDE
PREST-O-LITE ACETYLENE • OXWELD,
PUROX, PREST-O-WELD, HELIARC,
UNIONMELT EQUIPMENT FOR WELDING,
CUTTING, AND HEATING

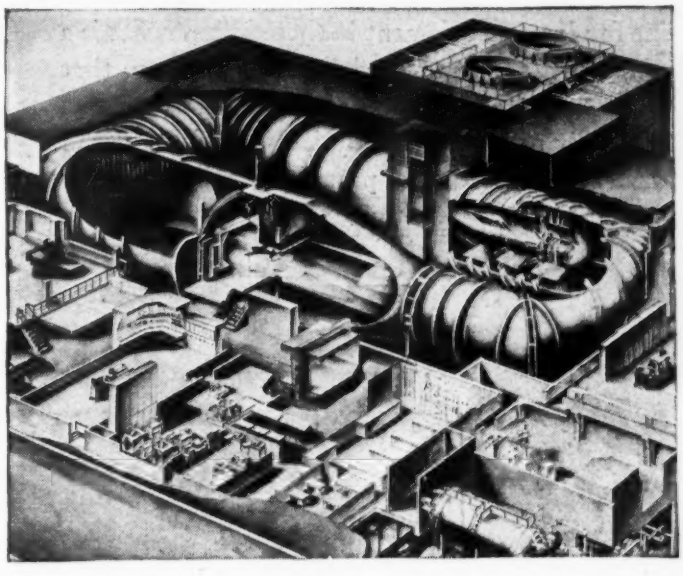
the way for the "Big Blow"

A typhoon is just a puff compared with the wind that whips through this test tube for model airplanes at Cornell Aeronautical Laboratory, Buffalo, N. Y. The "big blow" is created by two 22-foot diameter fans that can generate a wind of over 700 miles per hour.

The inside walls must be smooth, scale free, since this gargantuan blast would shear off any little specks and drive them through a valuable test model plane with devastating force. To prevent this, every little bit of scale was removed from the thousands of square feet of metal surface before painting by Linde's flame-priming process.

Flame-priming is simple to do, requires little equipment, and costs little. A brush of oxy-acetylene flames pops off scale and drives out moisture. Paint applied to the warm, dehydrated surface spreads easily, goes on smoothly, bonds tightly, and lasts longer.

Linde service engineers are always available to help with problems of treating, cutting, joining, and forming metals. Linde research is constantly at work on the development of new and better methods for the production and fabrication of metals.



Two huge 22-foot diameter fans, fabricated by UNIONMELT *welding, generate the wind for high-speed tests simulating high-altitude conditions.*

The words "Heliarc," "Linde," "Oxweld," "Prest-O-Lite," "Prest-O-Weld," "Purox," "Union," and "Unionmelt" are trade-marks of Union Carbide and Carbon Corporation or its Units.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

now HAGAN *makes*

Hagan Corporation has acquired all assets of Ring Balance Instrument Company, Chicago.

Manufacture of the full line of Ring Balance instruments will continue at the Company's Chicago plant; the design staff has been retained; but these instruments will now be backed by the material and technological resources of the Hagan Corporation. Sales and service will be handled by the present representatives of the Ring Balance Company, and by the district offices of Hagan Corporation. All activities will be directed from the Hagan offices in Pittsburgh.

* * * *

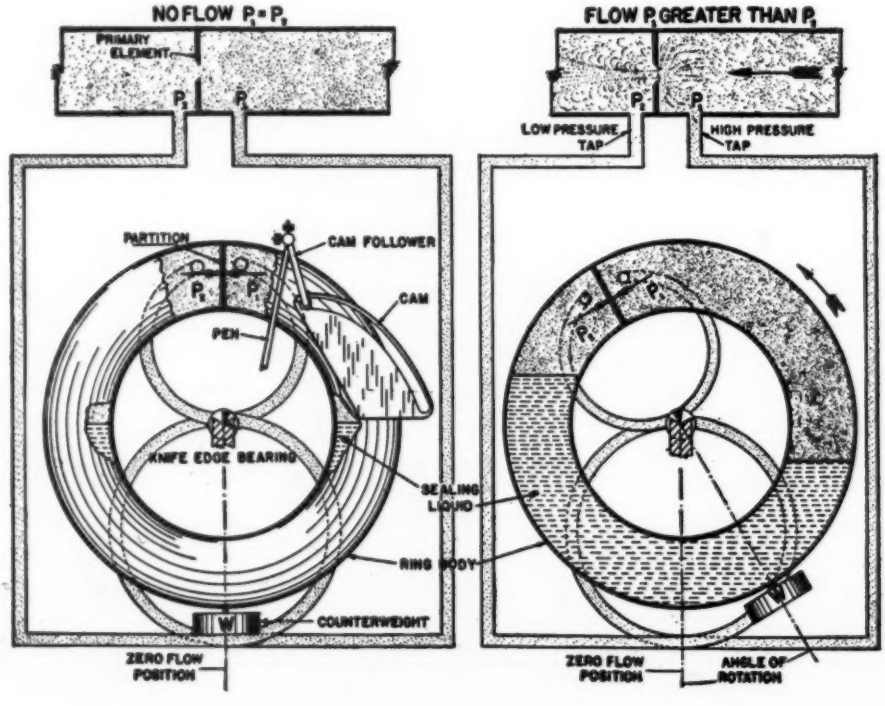
With this acquisition, Hagan becomes the only manufacturer to offer an extensive line of flow meters based on the ring-balance principle.

The fundamental element in these instruments is a hollow ring-body mounted on knife edges so that it can rotate easily about its axis of symmetry. The lower part of this body is filled with a liquid which serves as a seal. A partition across the upper part divides the ring into two distinct compartments, one of which is connected to the high pressure tap of an orifice, flow nozzle, venturi, or similar primary element. The other compartment is connected to the low pressure side of the element.

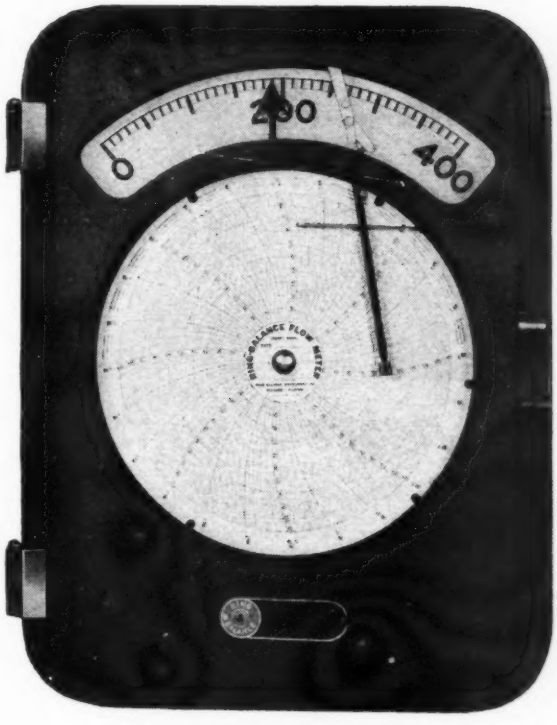
These connections are made by means of special flexible tubes. These tubes are an exclusive Ring Balance patented feature.

The torque created by the *differential pressure acting on the partition* causes the ring-body to rotate. A torque opposing this rotation is brought into play by an external counterweight rigidly attached to the ring-body or other suitable resistance systems. In either case the assembly is a symmetrical *ring balance*, and rotates only until the torque due to differential pressure is balanced by the torque exerted by the resistance system.

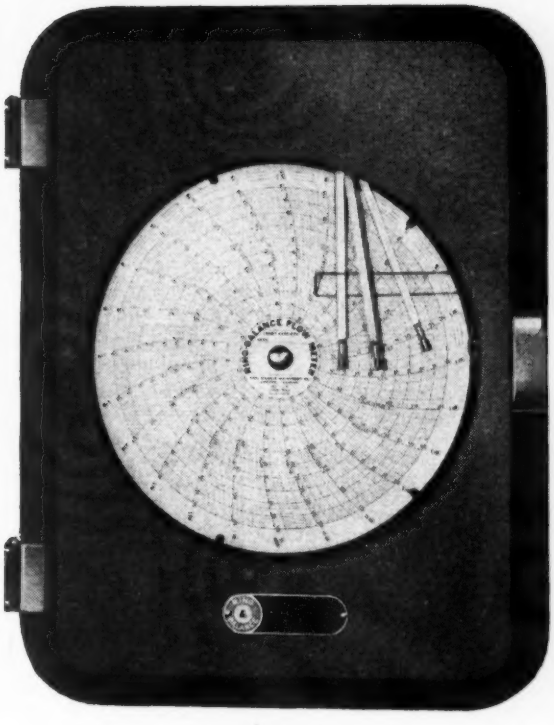
By means of a suitable linkage and cam, the angular movement of the ring balance is converted into readings of the rate of flow on an appropriate scale and in any desired units. In the ring balance meter the calibration is not dependent on the amount of sealing liquid.



Ring Balance meters



INDICATING—INTEGRATING AND RECORDING FLOW METER



RECORDING AND INTEGRATING FLOW METER

All instruments in the extensive Hagan Ring Balance line incorporate this fundamental principle and thus have certain inherent advantages.

1. They have a very high ratio of power to friction.
2. Meter capacities can be changed simply without taking meters out of service or dismantling them.
3. They can be calibrated without being disconnected or removed from service.
4. There is no stuffing box.

We will be glad to give you full information concerning Hagan Ring Balance instruments which have applications in your plant.

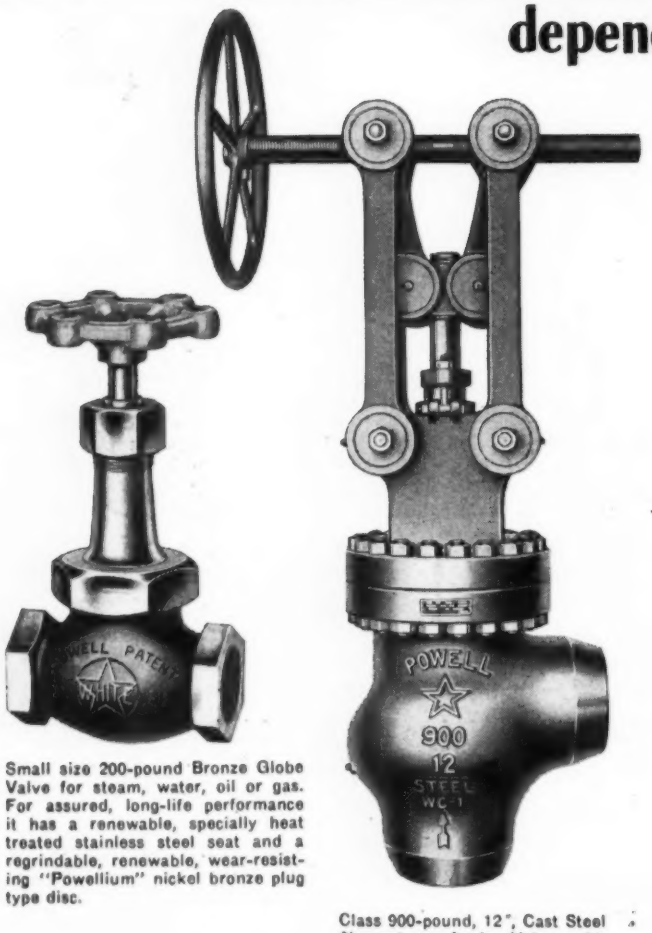
Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

HAGAN CORPORATION

HAGAN
HALL
BUROMIN
CALGON

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

depends on *perfect* control.



Small size 200-pound Bronze Globe Valve for steam, water, oil or gas. For assured, long-life performance it has a renewable, specially heat treated stainless steel seat and a regrindable, renewable, wear-resisting "Powellium" nickel bronze plug type disc.

Class 900-pound, 12", Cast Steel Non-return Angle Valve with welding ends and bolted flanged bonnet. Toggle operated.

The performance of an orchestra depends on the control exercised by the conductor. Without this control, the greatest aggregation of musicians in the world would make a sorry mess of the finest symphony.

Likewise, the smooth performance of an industrial plant depends on the valves which control the media necessary to its operation. And for perfect performance in flow control, the valves must be adapted in every way to the conditions under which they operate.

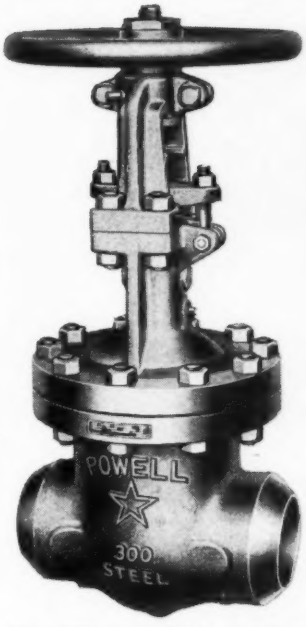
For more than a century, Powell Engineers have been designing valves to meet every new flow control condition as it has arisen.

Today there's a Powell Valve for every known requirement of the modern power plant. Bronze and Iron Valves of all types are available for low pressure steam, water, oil and gas lines. And for the higher pressures and temperatures, Powell offers a most complete line of Cast Steel Valves of all types —Globe, Angle, Gate, Check and Non-return— from Class 150 pounds to Class 2500 pounds, inclusive. When desirable, Powell Cast Steel Valves can be equipped for gear, toggle or motor operation.

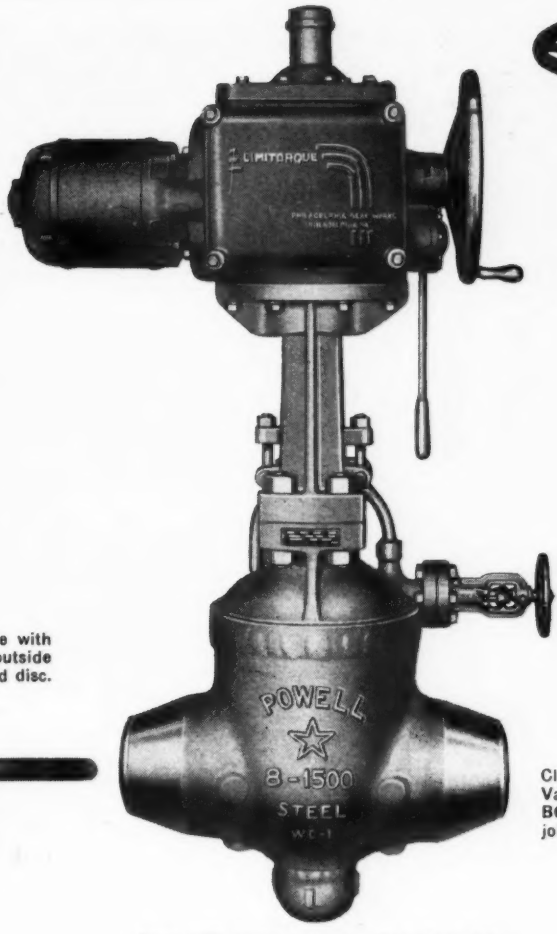
The Wm. Powell Co., Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

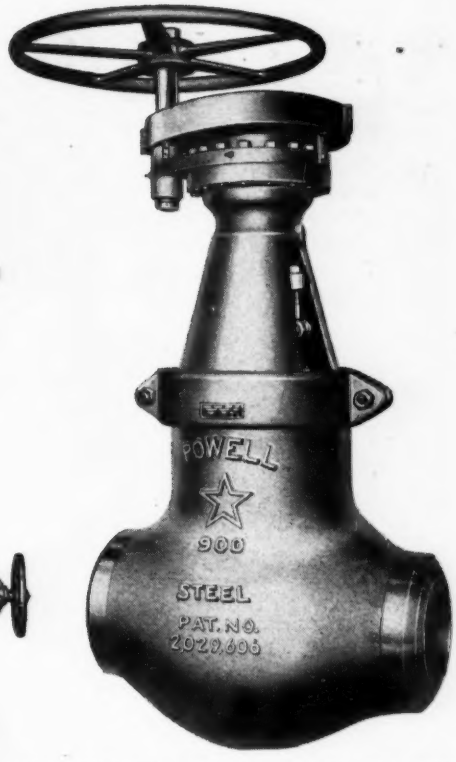
POWELL



Class 300-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and taper wedge solid disc.



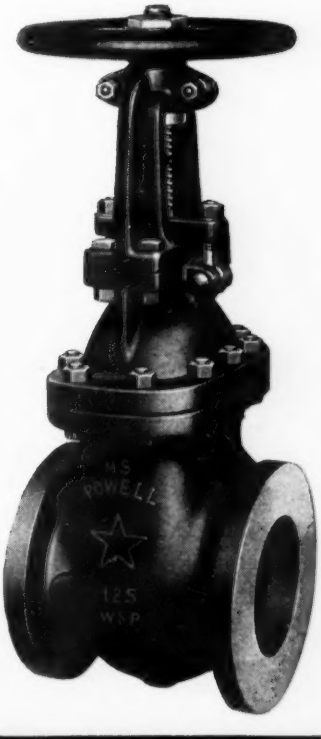
Class 1500-pound, 8", Cast Steel Gate Valve with welding ends, welded bonnet and special by-pass. Top mounted electric motor operator provides quick, positive opening and closing by remote control.



Class 900-pound Cast Steel Welding End Globe Valve with POWELL PATENTED PRESSURE SEAL BONNET. The internal pressure seals body-bonnet joint. Geared for easy operation.

Class 1500-pound Cast Steel Welding End Gate Valve with POWELL PATENTED PRESSURE SEAL BONNET. The internal pressure seals body-bonnet joint. Anti-friction bearings in yoke.

Class 600-pound Cast Steel Swing Check Valve, with welding ends and bolted cap. Disc has ample lift to permit full, straight-way, unobstructed flow through the valve when wide open.

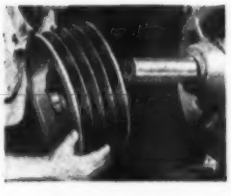


Large Iron Body Bronze Mounted Gate Valve for 125 pounds W.S.P. Made in sizes 2" to 30", incl. Has flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Taper wedge double discs can be provided in sizes 2" to 12", incl. Also available in All Iron.

VALVES

Save time . . . prevent damage to motor and shaft . . . with TEXROPE

"MAGIC-GRIP" SHEAVES



QUICKLY ALIGNED

Because it slides freely on the shaft, it's easy to line up the sheave accurately — for good alignment, smooth operating, longer belt life. It pays to standardize on "Magic-Grip" sheaves.

See Sweet's Catalog

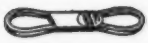
SLIPS ON EASILY

Comes completely assembled. Tapered split bushing provides clearance for even over-size shafts — it's compressed and locked to the shaft with an all-around clamp grip by tightening three cap screws. Can be removed as easily as it goes on.

HERE'S A SHEAVE that goes on *fast*. Less labor cost — less downtime. But that's only part of the saving. There's no forcing or hammering to damage motor bearings — no set screws to mar the shaft. Locks on with a powerful clamp grip that prevents backlash or wobble. And . . . it costs no more than a standard heavy duty sheave of comparable materials and precision workmanship.

Texrope "Magic-Grip" sheaves are made in diameters from 5.4 to 48 inches, two to 12 grooves. They're engineered by Allis-Chalmers, originators of the multiple V-belt drive. For specifications, prices, call your nearest A-C dealer or office. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2221

TEXROPE .. Greatest Name in V-Belt Drives



"Super 7" V-BELTS
Five Types — Sizes to suit every power transmission job.

Texsteel, Texdrive, "Magic-Grip"
— sheaves in a full range of sizes, grooves.

"Vari-Pitch" SHEAVES
Exact variations in speed, stationery or motion control.

SPEED CHANGERS
Speed variations up to 375% at the turn of a crank.

ENGINEERING
Finest V-Belt engineering talent in the world—at your call.

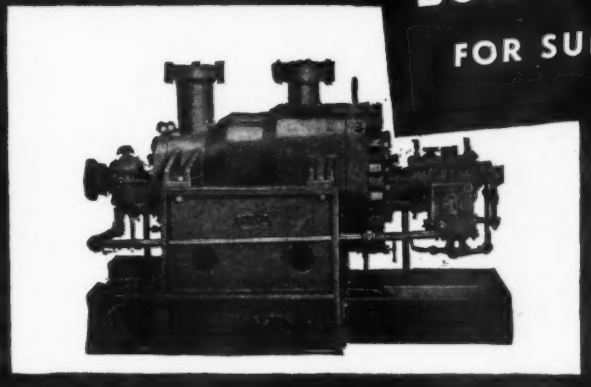
TEXROPE "Super 7" V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich. They are sold only by A-C.

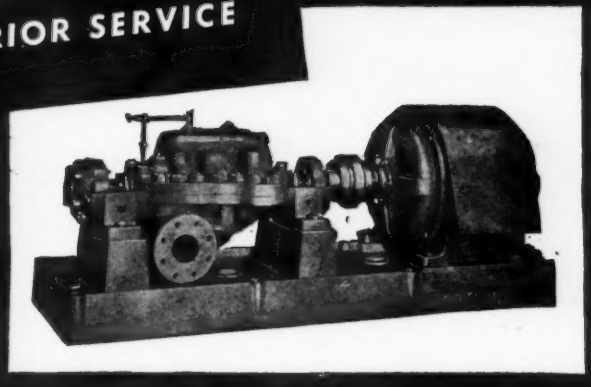
ALLIS·CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

SPECIFY WORTHINGTON BOILER FEED PUMPS FOR SUPERIOR SERVICE





With longest and broadest experience with boiler feed pumps for power plants, large and small . . . and the most complete line of boiler feed pumps for pressures, high and low . . . Worthington is best able to help meet your boiler feed requirements.

Whether the capacity is 50 or 3500 gallons per minute — the pressure 50 or 2500 pounds per square inch — there is a standard Worthington centrifugal boiler feed pump available.

Familiar with every type of boiler feed application, Worthington engineers are trained to select the economical, reliable arrangement . . . fitting feed pump to feed cycle.

Out of 100 years' experience . . . pioneering . . . inventing, came Worthington improvements such as the Elastic Seal Ring for tight interstage joints . . . the Multiple Pressure-Reducing Orifice for boiler feed by-pass service . . . and the Mix-Temp Cycle for interstage heating.

For full details on Worthington boiler feed pumps of which the WC and UQ Models shown above are typical, write us or phone our nearest district office.

Worthington Pump and Machinery Corporation, Centrifugal Pump Div., Harrison, N. J.

WORTHINGTON

C4-14

THE WORLD'S LARGEST MANUFACTURER OF PUMPS

For Boiler Feed Service
Capacities from 30 to 1500 g. p. m. Heads from 180 to 1000 feet.

For Hotwell, Condensate, Chilled Water, General Service
Capacities from 150 to 1300 g. p. m. Heads from 110 to 500 feet.

For Boiler Feed Service
Capacities from 25 to 1450 g. p. m. Heads from 220 to 1600 feet.

For Water Works, Circulation, Drainage, General Service
Capacities from 500 to 1600 g. p. m. Heads 900 to 3200 feet.

For Boiler Feed Service
Capacities from 200 to 1600 g. p. m. Heads from 900 to 3200 feet.

For Boiler Feed Service
Capacities from 500 to 3000 g. p. m. Heads from 2000 to 7000 feet.

the C-E Package Boiler

not one or two outstanding features, but—

a completely balanced design

Here is a *complete* unit — boiler, furnace, setting, fuel-burning equipment, control, forced-draft — *with every element in balanced relationship.*

Every feature you have come to expect from C-E leadership in steam generation is embodied in the Package Boiler, but none predominates at the sacrifice of others. Instead, you find perfect coordination of all components. Such a result can only be attained when all elements are of one manufacture. Knowledge, experience and facilities combine to assure full responsibility for performance from the fuel inlet to the steam outlet. This, C-E offers you in the Package Boiler.

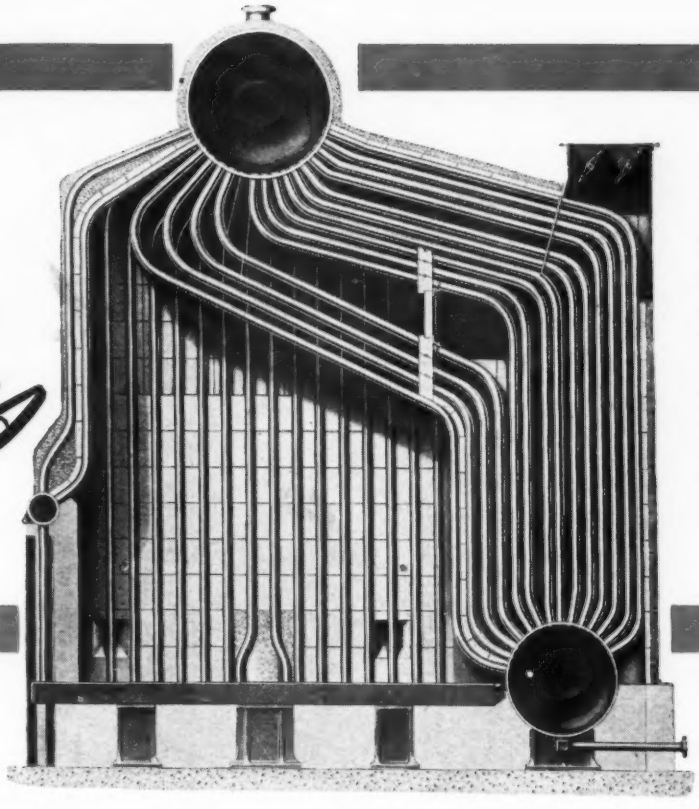
In price, performance and low maintenance, this completely coordinated unit outstrips any assembled compromise and gives you an added triple benefit — *one contract, one guarantee* and *one responsibility.*

If your requirements are in the available capacity and pressure range, you will find your complete answer in the C-E Package Boiler, the steam generator of Balanced Design. Investigate it today. B-127

COMBUSTION

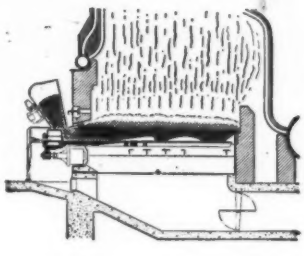
C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

offers

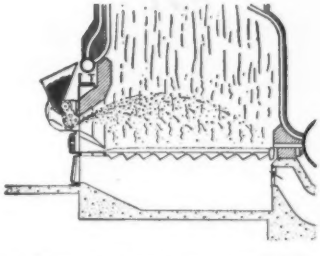


The Package Boiler is designed for four methods of firing — spreader stoker, single-retort underfeed stoker, oil or gas burners. The furnace is so designed and proportioned that any of these methods may be substituted for any other should a change in the fuel market make it advantageous.

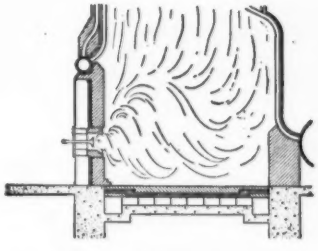
Type E Underfeed Stoker



Spreader Stoker



Oil or Gas Burner



Doesn't this describe the boiler unit you want?

1. The C-E Package Boiler is furnished in capacities from 15,000 to 40,000 lb of steam per hr, or more. It is designed for industrial load conditions, particularly in plants having small operating and maintenance forces.

2. The C-E Package Boiler operates efficiently over a wide range of output, takes rapid load swings, produces steam of satisfactory quality at all ratings, is simple to operate and is readily accessible for cleaning.

3. The C-E Package Boiler is symmetrical in design, like its famous prototype, the VU. Thus every foot of boiler width absorbs the same amount of heat, resulting in uniform evaporation across the boiler, uniform water level in the drum and uniform expansion of pressure parts.

4. Any tube in the furnace or boiler convection bank can be removed and replaced without disturbing any other tube.

5. Amply sized tubes reduce tendency for solids to deposit and are easier to clean. All tubes can be de-scaled from top drum.

6. A 48-in upper drum and 36-in lower drum provide for rapid load swings with low moisture carryover at all ratings.

7. Integral soot blowers enable the operator to keep tube surfaces clean at all times.

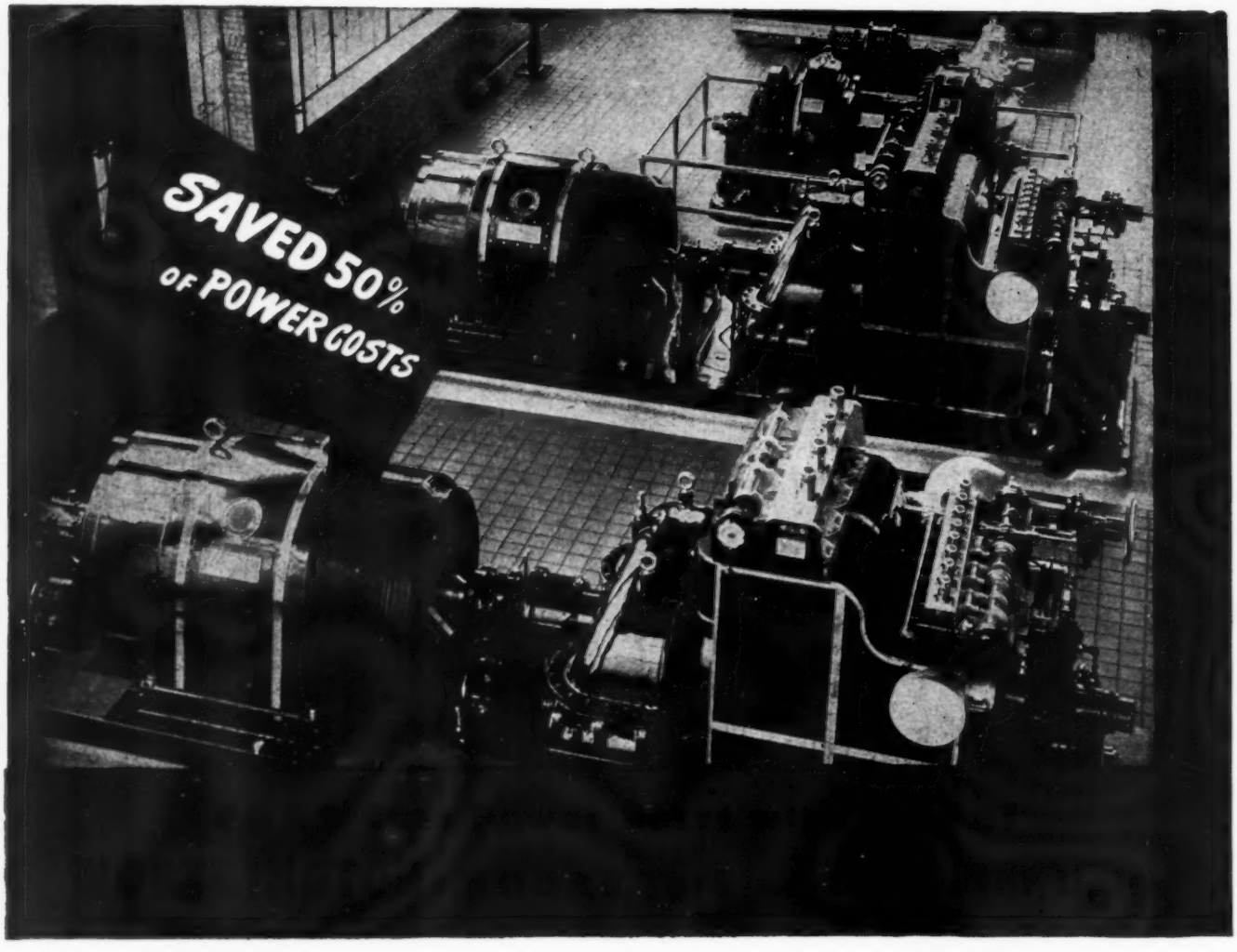
8. Front and side walls of the furnace are fully water-cooled, virtually eliminating refractory maintenance.

9. 4-in block insulation and steel-panelled casing back up the water walls and assure minimum radiation loss and a cooler boiler room.

10. Uniform distribution of gases, large radiant-heat absorbing surface and high hydrostatic head between drums combine to provide a fast steaming rate and quick response to load changes.

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.



Power costs have gone down 50% in the Ford Motor Company's Chicago power plant near the Calumet River. This is another example of how *modern* automatic extraction type turbines can cut power costs, far below costs of older methods of power generation. Superintendent reports "excellent service record during the period since installation with no interruption."

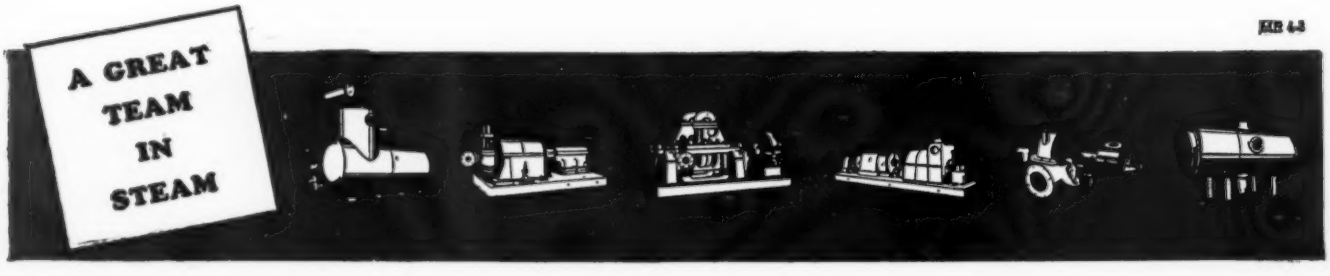
Engineered to Fit the Job

Taking 225 lb. 525° steam at the throttle, the Worthington-Moore turbines exhaust to the condensers, and automatically extract steam at 5 lbs. pressure to satisfy variable process and heating steam requirements.

Investigate WORTHINGTON-Moore Teamwork

In many other turbine-generator installations, firms like yours have profited from Worthington's broad experience with steam power plant equipment, plus Moore's years of turbine engineering and manufacture. Write us, or call our nearest district office. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, N.Y.*

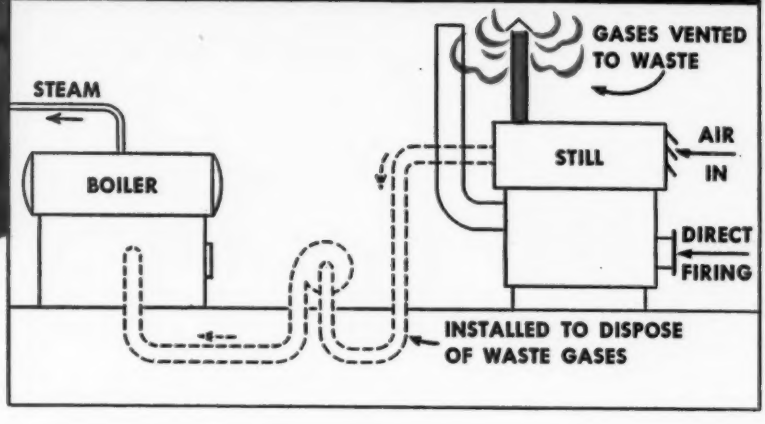
WORTHINGTON



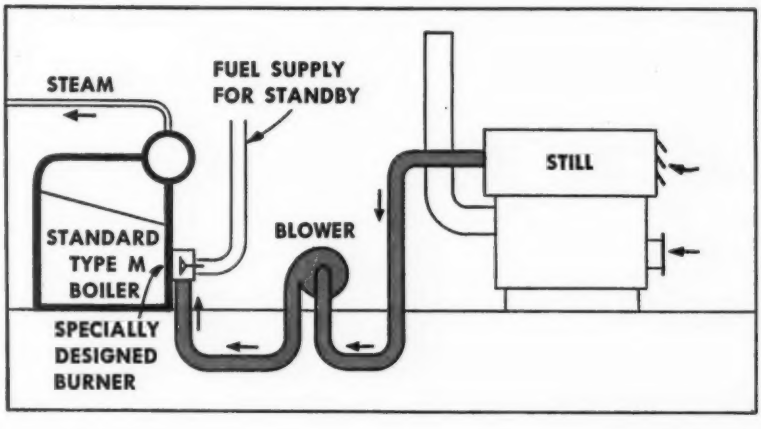
STANDARD BOILERS that meet many—

Special Requirements!

EXAMPLE: Asphalt Processing Plant



OLD — This simplified schematic diagram shows the original hook-up used by a processing plant in reducing heavy petroleum base stock to asphalt. Complaints about the odor of the waste gases led to their being piped to a boiler (dotted lines) where partial burning resulted.



NEW — Springfield Boiler Co. engineers, called in on the job to make recommendations on a new boiler plant, found that an arrangement could be provided, in conjunction with a Springfield Type M Standardized Boiler, whereby virtually all of the heat content of the waste gases would serve a useful purpose in firing the new boiler. As a result, fuel costs are lower and complete waste disposal is accomplished.

DO YOU need a special boiler? If it is a matter of getting early delivery at a reasonable cost, don't overlook the opportunities offered by the Springfield line of standardized Type M boilers. With component parts for a range of sizes in stock ready for finishing and assembly, Springfield is breaking many accepted customs in meeting early shipping dates and in giving customers boilers that meet specific needs. This is the result of the adaptability of the basic design, plus the broad experience of Springfield engineers in developing modern steam generators for every branch of industry. For information and recommendations, see your local Springfield Representative, or write.

SPRINGFIELD BOILER CO.
1953 E. Capitol Ave.
Springfield, Illinois, U. S. A.

ASK FOR A COPY OF THIS 12-page BULLETIN, OR SEE IT IN SWEET'S.

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

Looking for Us, C

REPRODUCED FROM AN OLD ENGRAVING IN SEARS PICTORIAL DESCRIPTION OF THE UNITED

1847 1947

A CENTURY OF SERVICE to Industry THAT MADE America Great

One of the Big 3 in Electric Power Equipment

COMPLETE POWER GENERATION MACHINERY — Steam Turbines, Condensers, Air Ejectors, Hydraulic Turbines, Generators, Boiler Feed, Condensate, and Circulating Pumps, Water Conditioning . . .

Motors — All Types

Texrope V-Belt Drives

Centrifugal Pumps

Blowers & Compressors

Crushing, Cement, Mining Machinery

Chemical & Pyro-Process Equipment

Chief?

We were here when Milwaukee was spelled M-I-L-W-A-U-K-I-E!

MILWAUKIE, 1847 — A struggling frontier settlement celebrates its first birthday... and a small factory in the center of town begins turning out its first product — *millstones.*

One-hundred years later, in 1947, this progressive metropolitan city salutes its oldest heavy machinery manufacturer — Allis-Chalmers . . . *one of the Big 3 in electric power equipment — biggest of all in range of industrial products!*

It is significant to know that today, practically every U.S. manufactured product is aided somewhere along its course by Allis-Chalmers equipment.

In building a *better* millstone, crusher, turbine, motor, V-belt drive — Allis-Chalmers has earned the respect and confidence of men in every industry.

* * *

Allis-Chalmers is proud to serve this basic pattern of American industry and economy: Power and Electrical — Mining and Rock-Processing — Ferrous and Non-Ferrous Metal Producing — Metal Working — Food — Textile — Chemical — Petroleum — Wood — Rubber — General Manufacturing — Transportation — Construction — Public Works — Agriculture — and National Defense.

ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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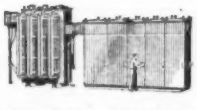
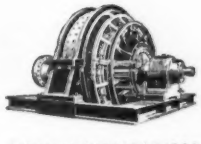
ALLIS·CHALMERS

PUBLISHED 1848

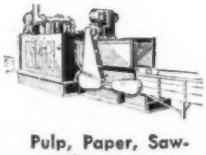
Biggest of All in Range of Industrial Products



POWER DISTRIBUTION — Switchgear, Voltage Regulators, Transformers, Circuit Breakers, Unit-Substations, M-G Sets, Mercury Arc Rectifiers . . .

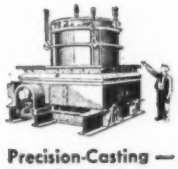


POWER UTILIZATION & CONTROL — Motors, Starters, "Regulex" Exciters, Electronic Heaters and Devices, Welders, Remote Control, Betatron . . .

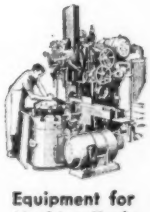


Pulp, Paper, Saw-Mill Equipment

Food, Milling & Extraction Equipment



Precision-Casting — Foundry Equipment



Equipment for Machine Tools

Marine & Defense Equipment

Farm & Industrial Tractors

A 2193

HERE'S A NEW "HIGH" IN

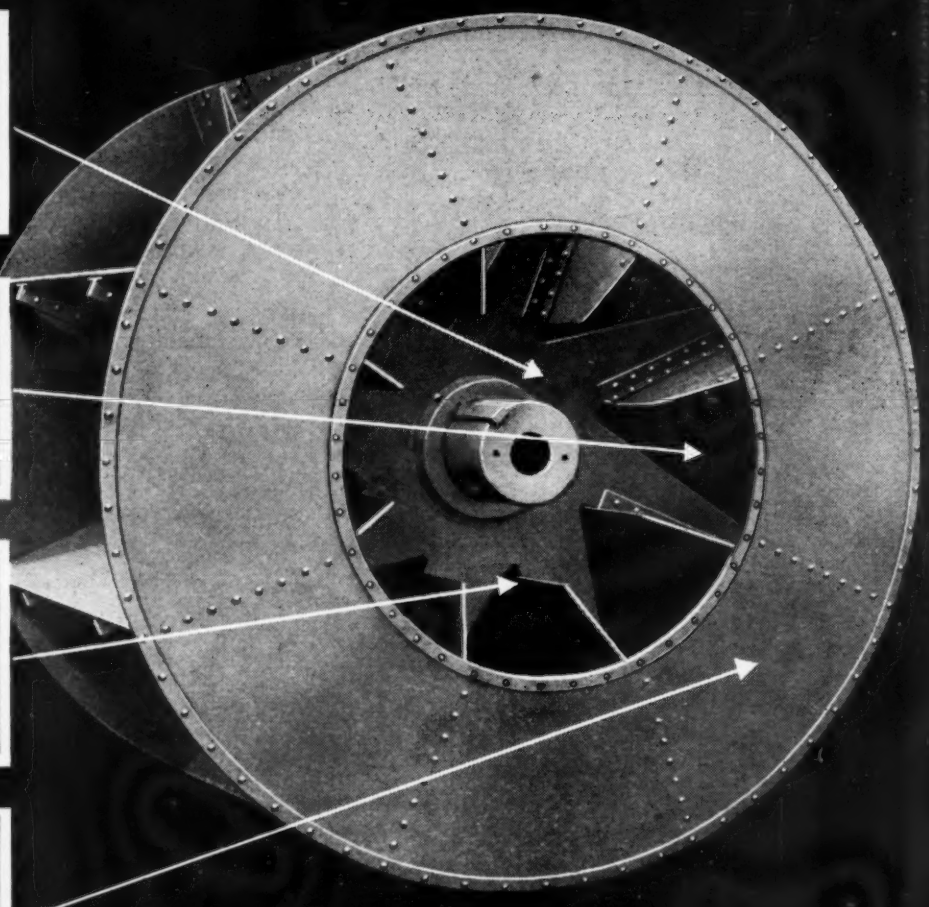
NEW "STREAMLINED" WHEEL DESIGN, FOR LONGER LIFE UNDER HIGH PRESSURES AND EROSIVE CONDITIONS

Centerplate of fan wheel formed from a single sheet of heavy steel with smooth flat inner surface. Minimizes fly-ash erosion.

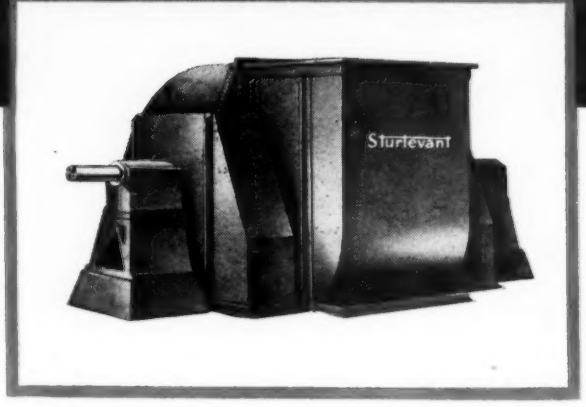
Fly-ash *attacks itself*—and not the wheel! Outer section of centerplate is cut out between blades. Incoming gases are directed against *each other*.

Ribbed liners on rotor blades provide extra wearing surface and increase life of wheel. Liners quickly and easily replaced.

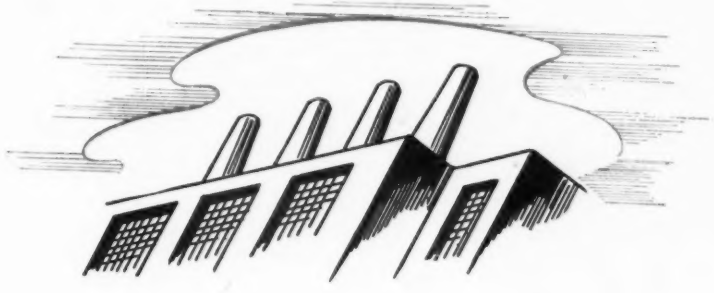
Each side plate formed from solid sheet. No welded or riveted joints—strongest, safest construction.



Heavy steel-plate housing securely braced and welded. Wheel removable without disconnecting duct work.



INDUCED-DRAFT FANS



Sturtevant induced-draft fans will handle 3,200,000 lbs of combustion gases per hour

...AT THE SUNBURY STATION OF THE PENNSYLVANIA POWER & LIGHT COMPANY

IT TAKES A LOT of "lung power" to handle the hot breath from a 400,000 lbs-per-hour steam boiler. And the Pennsylvania Power & Light Company's new Sunbury steam electric station will have *four* of these boilers, capable of supplying a total of 1,600,000 lbs of steam per hour!

This plant, engineered by Ebasco Services, Incorporated, under the supervision of the Pennsylvania Power & Light Company, will be equipped with eight Sturtevant steel-plate induced-draft fans—handling a total of 3,200,000 lbs of combustion gases per hour. Each of these 7½ foot fans has a capacity of more than 400,000 lbs per hour at more than 20" static pressure—and two fans will be used for each of the four pulverized-anthracite fired boilers.

A unique feature of these fans is the new streamlined wheel design – a companion design to Sturtevant's well known erosion-resistant TVID wheel, which has established outstanding service records in leading power plants from coast to coast.

The Sturtevant Division of Westinghouse Electric can supply *all* of your mechanical draft requirements—forced-draft fans, induced-draft fans, primary air fans, fly ash removal and collecting equipment—plus complete electric or steam drive.

For further information, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

Westinghouse

Sturtevant

DIVISION

You Can PREVENT MOTOR BURNOUTS *by Protecting Motors with* BUSS FUSETRONS

Quote: "In six months we lost only one motor out of 2000 that were protected by Fusetrons..."

"Ours is a duct job with plug-in switches feeding individual machines with disconnect switches on all machines. Our method of installation is to put Fusetrons of wire capacity size in the plug-in switch on the duct. Then we place Fusetrons of motor protection size in the disconnect switch.

"We started production in June, 1946, with upwards of 2000 motors in operation. Up to the present time we have burned out only one motor and that was on an abnormal installation out of the protective reach of any thermal overload device.

"We are planning a new plant addition, and because of their performance, it will be 100% Fusetron equipped."

Large Indiana Manufacturer
(Name on request)

WHY FUSETRONS CAN GIVE MOTOR PROTECTION

Fusetrons have a tremendous time-lag. Thus, on normal installations, they can be used in a size near to the actual running current of the motor without opening on motor starting current or other harmless overloads.

When so used, Fusetrons protect motors on normal installations from ANY harmless excess of current—caused by such things as being stalled, lack of oil, worn bearings, tight belt, overloading, wrong voltage or single phasing or anything that causes the motor to draw a dangerously excessive current.

BUSS

Fusetrons Give *Double Protection* to Large Motors!

Of course, larger motors are protected with thermal cutouts or overload relays. They save many motors—but experience shows that such devices sometimes fail to operate and a motor burns out.

By replacing fuses used for short-circuit protection with Fusetrons of MOTOR-RUNNING protection size, you get the same short-circuit protection PLUS DOUBLE PROTECTION against motor burnout from a single phasing or other electrical overloads.

FUSETRONS will act independently to save the motor. There is nothing to stick, nothing to go wrong. They cannot be reset nor can corrosion or dirt lengthen their blowing time. When the solder in the thermal cutout melts the circuit is open—there is no way it can be held in or jammed.

FUSETRONS provide simplest way to prevent damage from single phasing

When single phasing occurs the current flowing through Fusetrons in the remaining phase increased about 100%. (Theoretically 73% but change in efficiency and power factor makes it about 100%).

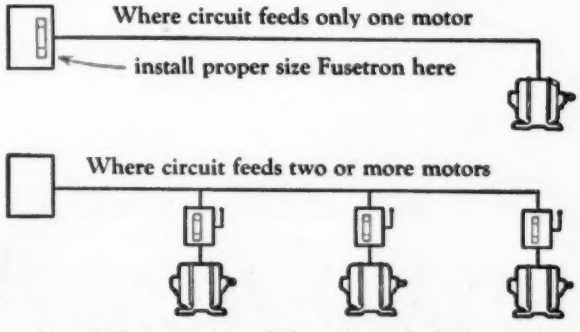
This 100% overload on Fusetrons of MOTOR-RUNNING protection size opens them and STOPS FLOW OF CURRENT to the motor.

Never before has such dependable single phasing protection been available to prevent motor burnouts.

FUSETRONS make protection of SMALL Motors against burnout, simple and inexpensive

Heretofore, SMALL motors have often been left unprotected because the cost of protection has been too great compared to the cost of replacing the motor. Yet a burnout means replacing the motor—PLUS the loss of labor and production.

Now look how simple it is to avoid such losses . . .



Install Fusetron in switch or fuse block to protect each individual motor . . . or on portable tools or devices, install Fusetron in attachment plug or connector or in a fuse block attached to device.

FUSETRONS Give Many Other Kinds of Protection Heretofore Not Available

Fusetrons do everything fuses do, as is confirmed by the Underwriters' Laboratories' Label, and in addition:

★ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads. ★ Give thermal protection to panelboards and switches. ★ Prevent needless blows caused by heating in panels and switches. ★ Permit use of larger motor or adding more motors on circuit without installing larger switch or panel. ★ On new installations proper size switches and panels can be used instead of oversize. ★ Protect coils, transformers and solenoids against burnout. ★ Protect motors against burnout (see above)

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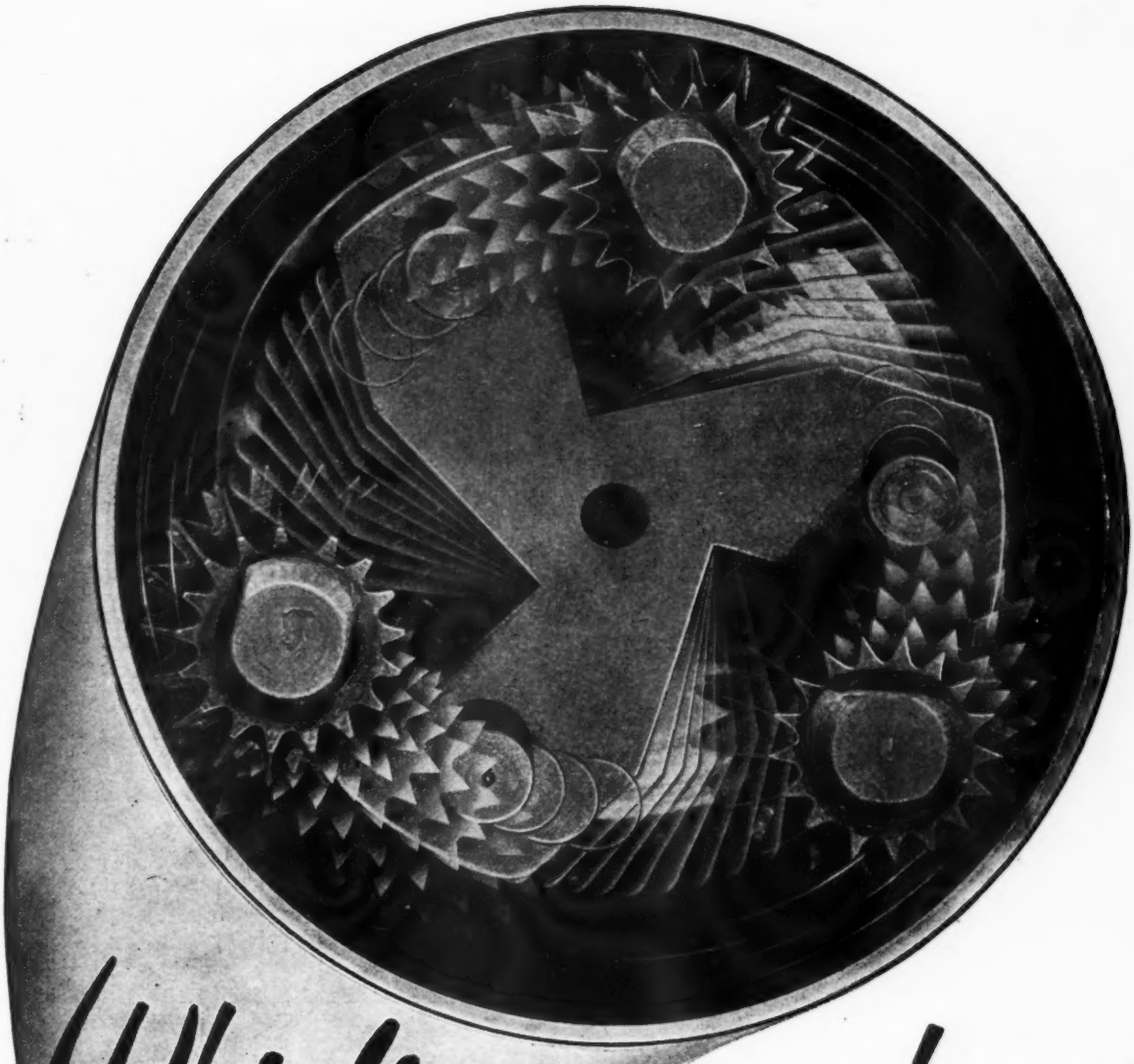

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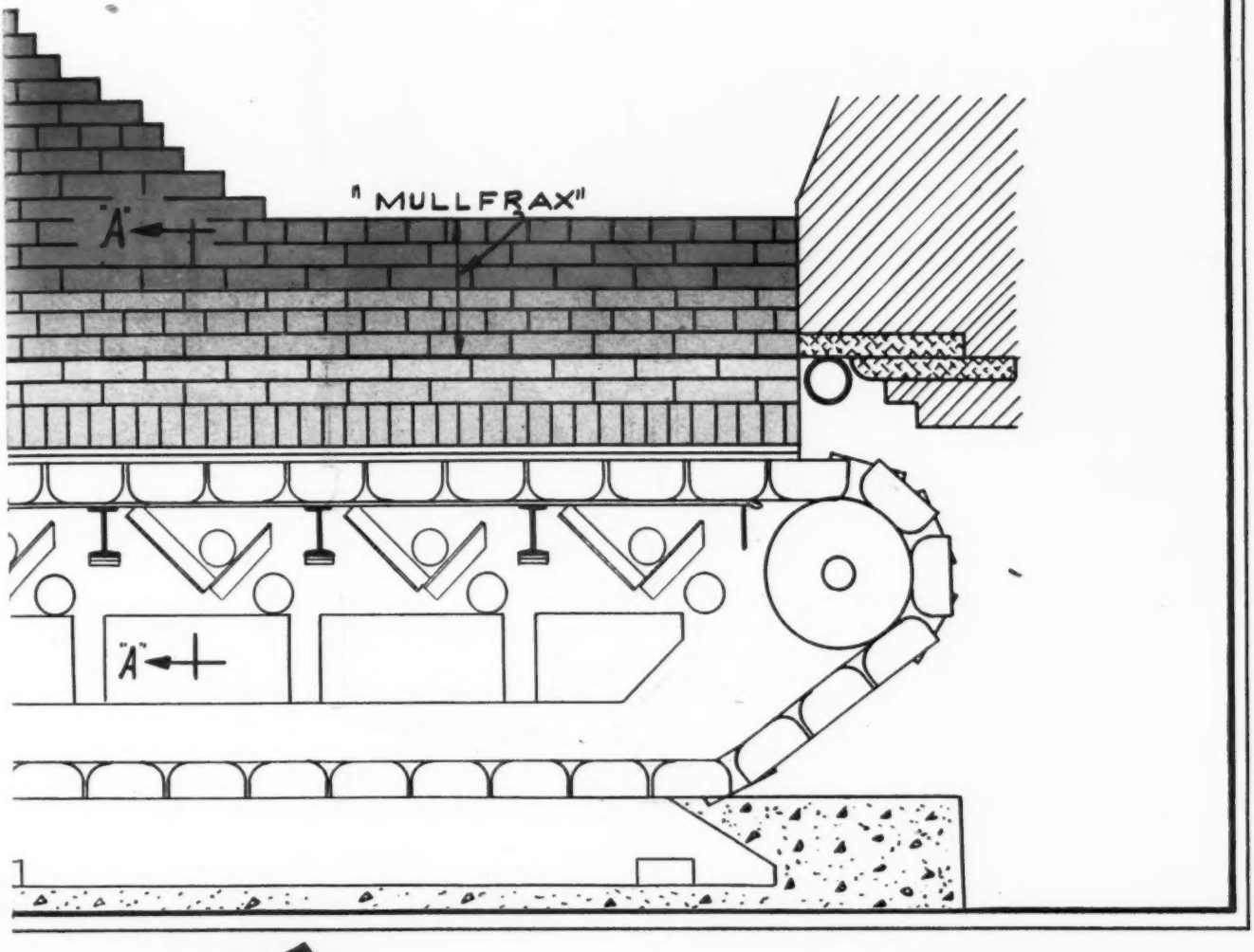

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MAY 1947

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
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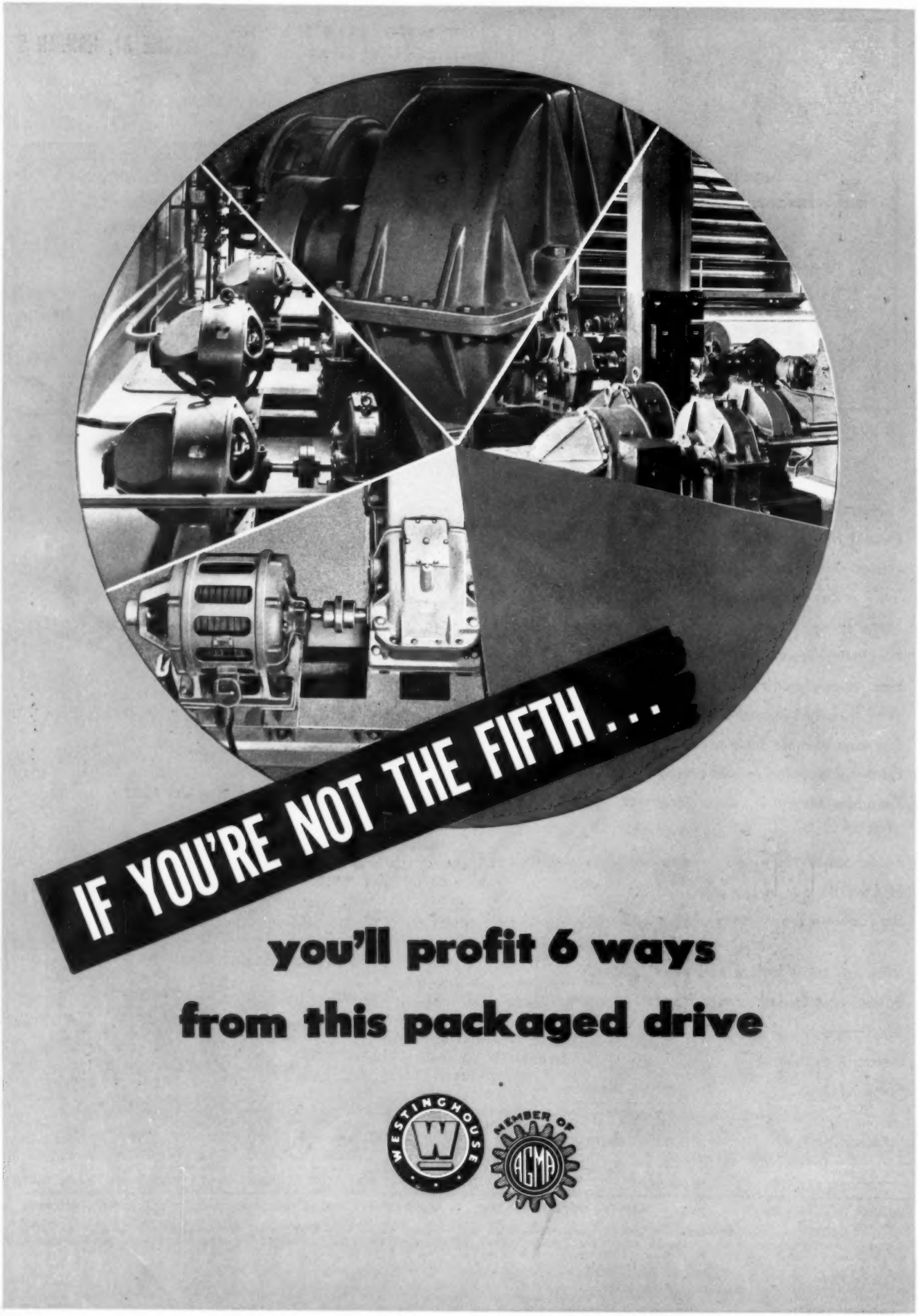
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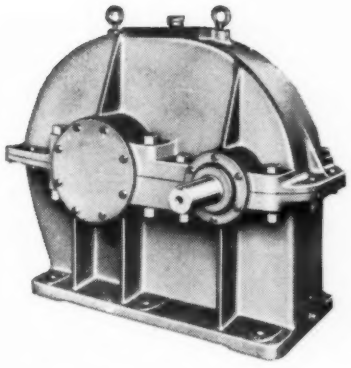

This Type SH speed reducer is a single-reduction unit which is furnished in thirteen standard ratios in each of twelve sizes. The Type DH speed reducer, which is a double-reduction unit, is offered in fifteen standard ratios in each of twelve sizes.

Because 4 out of 5 machines operate at slower speeds than their prime movers supply, you stand to gain six ways when you put Westinghouse speed reducers to work for you:

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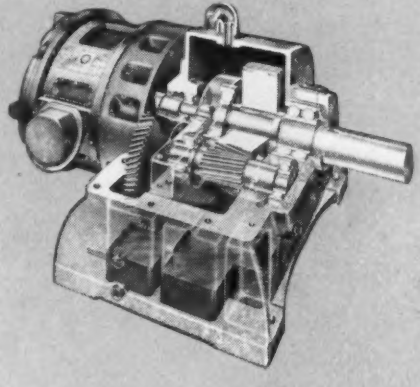

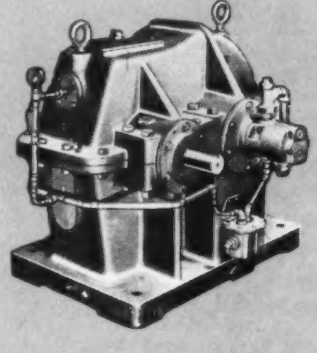

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These efficient, economical gearmotors give you the best in modern speed reduction for drives from 1 to 75 hp. Easy to install, simple to service and adaptable for all types of drives and motors. Three types—A, C and E—are available and provide output speeds of 1,450 to 16.5 rpm. All unit types can be used with either single-phase, polyphase or d-c motors.

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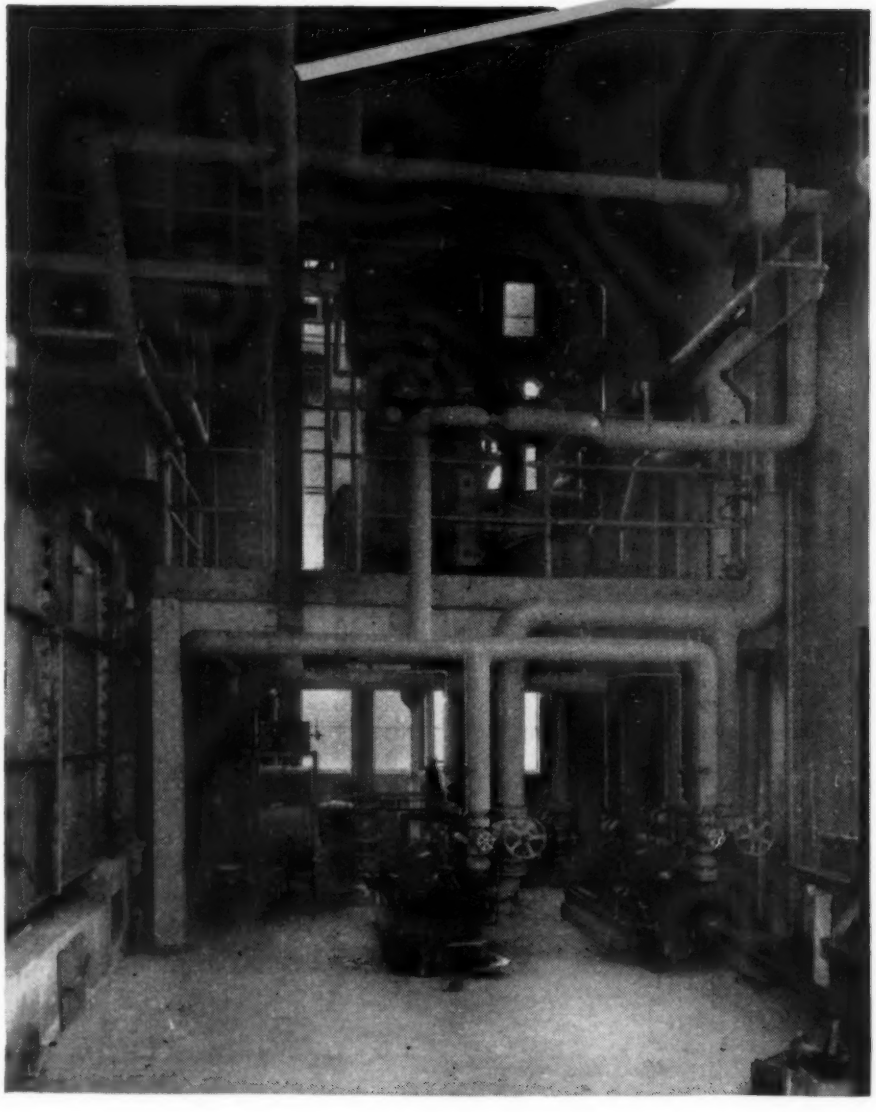
4 out of 5 drives need speed reduction

Byers Wrought Iron Pipe handles half a dozen tough assignments here



This good-looking piping layout in the new boiler house at Denison University, Granville, Ohio, meets the "handsome is as handsome does" test. Pipe materials were carefully selected to meet service conditions. Byers Wrought Iron pipe was installed in half a dozen highly corrosive lines: condensate system in boiler house and buildings; overflow and drain piping in boiler house; boiler blow-off piping; domestic hot water piping; and all supply and return piping in the extensive underground-overhead steam distribution network that serves a number of detached buildings.

Because conditions vary so widely, all of these services may not be problems in your plant. But there is one that is always a headache: condensate returns. Regardless of the character of feed water, condensate is invariably aggressive, and while treatments of various kinds may help, the only basic solution is the installation of a corrosion-resisting material. Wrought iron has been so uniformly successful in this service, that it should be carefully investigated whenever you are building or repairing, and are aiming for maximum durability.

The same facts apply in distribution systems, whether the pipe is subject to corrosive attack from the weather, from soils, or from humid conditions in pipe tunnels.

Wrought iron's resistance to corrosion comes from its composition and structure, which are duplicated in no other material. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack. This discourages the pitting and rapid penetration that generally causes ordinary materials to fail. The fibers also anchor the initial protective scale, which shields the underlying metal.

Our bulletin, "Wrought Iron for Piping Systems," discusses some of the corrosive conditions found in various services, and illustrates a few of the many places where engineers have successfully applied wrought iron. Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

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POWER

PHILIP W SWAIN, EDITOR • MAY 1947 • ESTABLISHED IN 1882

The Busiest Years of Our Lives

THE STATISTICS are impressive enough—12,000,000 kw of new power facilities on order or under construction—but one must go out on the firing line to see clearly that the power engineer faces the busiest five years he has ever known, in war or peace.

Two POWER editors have just returned from surveys of areas where activity is at its greatest pitch. Associate Editor Ben Skrotzki traveled some 4000 miles through the Southeast. Managing Editor Lou Rowley is just back from a 7500-mile swing through the Southwest and Pacific Coast areas. Their findings are much the same: Urgency of new construction varies from place to place, ranging to critical in some areas, but nowhere is power a surplus commodity.

Why, with all the plant expansion of war years, should this be so? There was substantial construction of power facilities during 1941-45, but even the well informed are apt to forget that it was deliberately held to a small fraction of the construction that load growth indicated. Three-shift operation, pooling, war time, brownouts and dimouts, and operation with much smaller reserve margins, made it possible to meet war-production needs with a minimum of new installations, thus releasing production capacity for naval- and merchant-vessel drives. We came out of the war with a national power plant that was adequate, but without an ounce of "fat."

After V-J Day the drop in industrial load lasted weeks instead of months, as expected. Soon industrial demand shot past its wartime peak. At the same time lighting, commercial and domestic loads skyrocketed.

And so the need to build new capacity is greater today than it was during the most hectic war years. Yet there is hope that the tight power situation will not generally become critical. By maximum use of present facilities, and by pushing construction to the limit, demands may be met in all but isolated instances. For these, some form of rationing may be needed, if lack of rainfall cuts too deeply into hydroelectric generation.

This upsurge in power demand brings with it new trends and new problems in addition to the immediate one of building to the load. Typical is the changing energy-source picture on the Pacific Coast. In years past, water-power resources were abundant and the Coast power systems grew on a hydro backbone. In addition, fuel was abundant and cheap— gas and oil in southern areas and waste wood in the Northwest.

These conditions dictated a power pattern in which most publicly distributed power was hydro-generated, with steam plants for standby. Cheap power, low-cost fuels and little need for building heating made private generation relatively rare except in certain industries. Government development of the Colorado and Columbia Rivers seemed to reinforce this pattern and assure its permanence.

Nevertheless, the signs of change are visible today, although it is yet too soon to forecast their outcome in detail. With the possibilities of further development of the Colorado in doubt and with only relatively small sites remaining in the coastal ranges, hydro resources available to California seem limited. In this area today many standby plants operate on base load, and most expansion is in steam facilities.

In the Northwest the situation differs in that the resources of the Columbia and other rivers of the area are barely tapped; their further development will relieve the power-supply tightness.

Demand for petroleum products and gas shows signs of outstripping production, and the need to encourage new discoveries has led to an increase in price. After long years as an exporter of petroleum, California may become an importer. In the wood industries of the Northwest new production methods and development of useful products from waste are taking hogged fuel out of the general picture.

These trends toward changes in energy sources on the West Coast are symptomatic of changes that will occur in all parts of the U. S. and eventually the world, as power demand rises with living standards and population growth. Even beyond the tremendously busy five years ahead of us power engineers face a continuing challenge, for *every economic and social change in this country, or in this world, demands more power to implement the change.*

Great "Labs" Organize Atom Research To Serve America

Headed by David Lilienthal of TVA, the Atomic Energy Commission will run a vast empire of nuclear research and atomic-power development. Robert Colborn here completes a report to the McGraw-Hill Atomic Energy Committee

David E Lilienthal, former head of Tennessee Valley Authority, and now appointed chairman of United States Atomic Energy Commission, has been the storm center of Congressional debate on the subject of atomic control

▶ IN PICKING KEY MEN to run the socialized atom industry the Administration leaned on men who got their training in the Tennessee Valley Authority. Atomic Energy Commission's Chairman David Lilienthal, storm center of Congressional atomic-control debate, was for years chairman and guiding spirit of TVA—also chairman of the Committee that did the spadework for the Baruch proposals for international atomic control. Also from TVA are AEC General Counsel Herbert Marks and Budget Director Paul Ager.

From previous direct or indirect association with atom bombs come Production Director Col Walter J Williams, General Manager Carroll Wilson and his assistant, John A Derry. Robert F Bacher, the only scientist on the Commission, was one of the leading physicists at Los Alamos, New Mexico, where the mechanism was developed.

Other AEC key men include: Personnel Director Lyle Belsley, Research Director James B Fisk, Military Director Colonel (soon General) James McCormick, Sumner Pike, Lewis Strauss and William Waymack.

In another five or ten years the AEC may become one of the most powerful economic planning agencies of the Federal Government. For the present it is a manufacturer of atomic bombs and a research agency to advance the theory and applications of nuclear physics.

In his first article, April, POWER, *page 64, Mr Colborn predicted commercial atomic-power plants in the not distant future, summarized power prospects and difficulties, suggested split-atom applications in chemistry, medicine and research, discussed the Atomic Energy Commission and the political implications of atomic control in relation to McMahon Atomic Energy Act.*—EDITOR

SEVEN BIG LABORATORIES

The four laboratories now functioning are Clinton Lab at Oak Ridge, Tenn., operated by Monsanto Chemical Co; Argonne National Lab at Chicago, operated by the University of Chicago; Berkeley Radiation Lab at Berkeley, Calif., operated by the University of California; Los Alamos Lab in New Mexico, nominally operated by the University of California.

Units being built are Brookhaven National Lab, Patchogue, Long Island, N. Y., operated by a group of Eastern universities; Knolls Lab at Schenectady, N. Y., operated by General Electric Co; Dayton Engineer Works near Miamisburg, Ohio, operated by Monsanto Chemical Company.

PATTERN FOR RESEARCH

This rather hodgepodge assortment of facilities represents the remnants of the bomb project, as AEC takes over. The final revamped pattern may include these elements:

Los Alamos Lab will remain the chief center for actual atomic-weapon development. GE at Knolls will concentrate on generating usable power from atomic piles. At Clinton, Monsanto will likely emphasize the chemical problems of pile operation and the production of isotopes. The job to be done at the Dayton Works has not been revealed.

Most of the more fundamental research will center around a group of regional "national" laboratories. These will eventually handle much of the outside contract research. They will guide and finance the bulk of university nuclear research.

Argonne and Brookhaven are two such units approved so far. Very likely another will be formed on the West Coast around the present Berkeley Lab. Later there may be a Southern laboratory and one in the Northwest. Ideal visualized is that every major university will be within an overnight train ride of one of these units. The laboratories in this group will have a double function—regional and national.

As a national organization, each of these regional laboratories will be responsible for some rather definite angle of the AEC's research progress.

THE PILE DESIGNERS

The Argonne Lab in Chicago will concentrate on the fundamental design of atomic piles without stressing the practical details of power production. The immediately important job is to build piles that can run "hot," say, at the 900-F temperature level of modern steam plants. This will be a considerable jump from the lukewarm operating conditions in the research piles at Chicago or the production piles at Hanford. The Chicago piles ran cool because of their low output—the Hanford piles because plutonium production was their sole objective. Elaborate water cooling at Hanford carried undesired heat to waste.

Argonne Lab must study a host of related problems: The relative merits of such "moderators" as graphite, heavy water and beryllium; characteristics of piles using various concentrations of U235 or plutonium; metallurgy of uranium; mechanical, chemical and nuclear characteristics of structural pile material under the conditions of an atomic fire.

The "Longhairs." The Brookhaven National Laboratory (see April POWER, p 67) is still hardly more than an abandoned Army camp, a few holes in the ground, and a $20,000,000 allocation. Brookhaven will focus on basic nuclear research—such matters as the nature of the different subatomic particles and of the mysterious "binding force" that holds them together at the center of the atomic structure.

THE ATOMIC BIG GUNS

If and when a national laboratory is set up on the West Coast it will probably inherit from the Berkeley Radiation Laboratory a special interest in the design and construction of particle-accelerators (atom smashers). These rank with the atomic pile as major tools of nuclear research.

These linear accelerators—cyclotrons,

Colonel Walter J Williams, AEC director of production and manager of field operations, helped build the gigantic U235 separation plants located at Oak Ridge, Tennessee

Carroll Wilson, general manager of Atomic Energy Commission, was formerly assistant to Vannevar Bush, head, wartime Office of Scientific Research and Development

synchrotons, betatrons, and so on—act as "guns" or "slingshots" for the atoms or pieces of atoms that serve as high-velocity bullets for atom-splitting experiments.

REGIONAL ROLE

In addition, each national laboratory will tie together the nuclear research carried on in all the neighboring universities and research institutions. Each laboratory can pool equipment for the surrounding universities. Piles, accelerators, "hot labs," and the like, are far too expensive for most college budgets. Most Government financing of university atom studies will channel through these regional laboratories.

ARGONNE LABORATORY

Most fully established of the national laboratories is the Argonne. Under its former name, Metallurgical Laboratory, it was one of the first of the Manhattan District facilities, antedating Oak Ridge and Hanford. "Metallurgical" developed the first atomic pile and did much of the basic work on the plutonium process. Its present budget is about $6,000,000 a year.

Present facilities, all in or near Chicago, include some University of Chicago buildings and a group of typical wartime sheds in a field 25 miles out of the city. This last now houses the world's first graphite pile and a later heavy-water pile, the only one ever built.

Announced recently were plans for a wholly new $20,000,000 plant outside Chicago to include at least one new pile.

The Argonne Lab will be managed by the 25 participating institutions.

THE BUSINESS MEN

The atom is one band wagon that U. S. industry has shown little eagerness to get aboard. Of the hundreds of companies involved in bomb projects during the war, many are unattracted by the postwar atom program; some have pulled out. Du Pont gave up the operation of the Hanford (plutonium) Works. Eastman Kodak Co, which ran electromagnetic separation at Oak Ridge, shows little present interest in atomic work.

On the other hand, General Electric, Monsanto and certain other firms show increasing interest. GE is operating Hanford and will run a new AEC laboratory at the Knolls outside Schenectady. Monsanto took over management of the Clinton Lab in mid-1945, and is building a smaller laboratory for AEC at its research center in Dayton, Ohio.

As general counsel of AEC, Herbert S Marks (formerly of TVA) must beat a path never before trodden by a lawyer

G. Lyle Belsley, director of organization and personnel for AEC, was formerly the executive secretary of WPB

There are many reasons, good and bad, why business men should hesitate to hitch their wagons to the atomic-energy star. For one thing, they suspect that atomic energy may be headed for socialization, and that firms tying in with the atom may have to spend large sums with little hope of return.

Also, during most of last year Congress was still trying to make up its mind on postwar control over atomic activities. Even after the passage of the McMahon Act there was doubt as to the policy under which the Atomic Energy Commission would exercise its broad discretion.

It is now clear that industry will have its place in atomic development, but for the present, at least, only on a non-profit basis, and with international uncertainties still overhanging the whole situation.

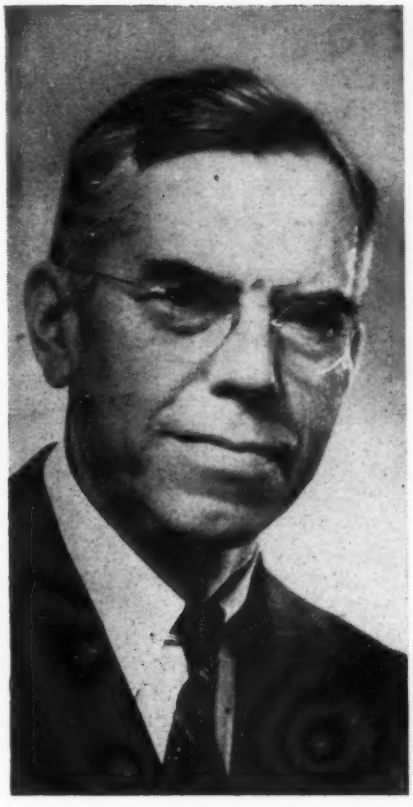
Industrial firms thinking about an aggressive program of atomic work are therefore necessarily gambling. They may eventually be forced out of the field, or they may never get into a position where they can make any money out of nucleonics. On the other hand, the few firms that do take the big chance may achieve a very advantageous inside track in the long run.

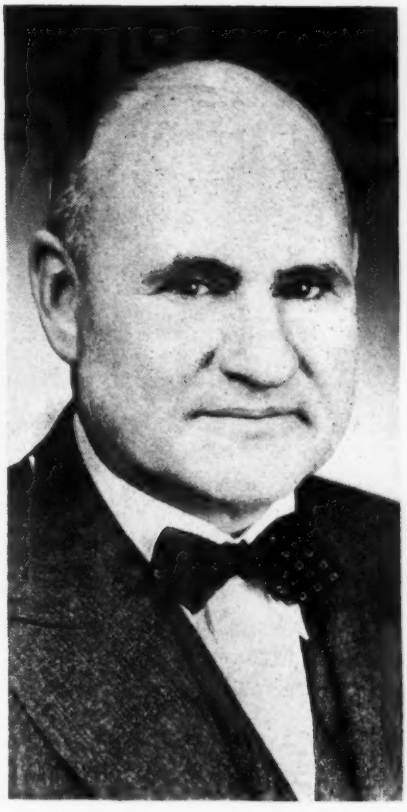
GE BETS ON ATOMIC POWER

For General Electric the bet is perhaps safer than for most firms. With its tremendous stake in the applications of electricity, GE cannot afford to overlook the probability that exploitation of atomic energy will increase the world availability of electric power, and build demand for all the gadgets that generate, transport, transform and apply electricity.

The ultimate decision as to who shall build and operate atomic piles may throw the piles to atomic firms, to a Government agency, or to an international body. At worst, the odds favor a profitable business in furnishing the specialized and complicated associated equipment—heat exchangers, control devices, mechanical and electrical equipment.

GE is determined to accumulate early know-how that will make it the largest supplier of such equipment. The company may not hope, however, to corral atomic patents. The Government (AEC) will own all discoveries. Also the government will pay the bills.





GE's 3-man atom team (Nucleonics Committee). Left to right: H A Winne, v-p in charge of engineering policy; Dr C G Suits, v-p and director of GE Research Lab; Dr Z Jeffries, v-p and general manager GE chemical dept

PRODUCTION, RESEARCH

Last September, General Electric assumed the management of Hanford. Major changes there scheduled include establishing an engineering and design unit at the plant—also a school of nuclear engineering.

One must remember that Hanford was originally built solely to make plutonium for bombs. High pile temperatures were unnecessary and undesirable, so the piles were cooled to lukewarmness by vast quantities of circulating water from the Columbia River. The resulting operating temperatures were far too low for economical power generation.

As it converts Hanford from war to peace, GE faces vast modernization problems, notably much higher pile temperatures to permit making byproduct power from the heat evolved in pile operation. Also endless advances are possible in uranium handling and the chemical separation of fission products and plutonium.

Already the $20,000,000 Knolls Atomic-Power Lab is beginning to take shape on its vast plot near Schenectady. Operation will be rolling by mid-1948. Owned and operated by GE, the Knolls layout will include at least one atomic pile as well as elaborate facilities for research in physics, chemistry, metallurgy and engineering.

Although Knolls Lab will do much of the research work for Hanford, its major job will be to develop techniques for using atomic energy in central stations and for ship propulsion.

The Knolls researchers face big engineering problems in converting the pile's heat output into usable power. Perhaps the hardest step is getting the heat out of the pile at a temperature suitably high for power production.

The heat-transfer fluid selected must meet requirements never before faced by power- or heat-transfer fluids. For example, neither the fluid nor the piping that holds it can offer appreciable obstruction to the neutron hail that maintains the chain reactions. Both fluid and pipe must remain substantially unaffected by the neutron bombardment. Also, of course, the fluid must be pumpable and noncorrosive. Since the piping cannot be thick walled, the fluid contained must not develop high pressure at the pile's operating temperature. For this reason and others water won't do as the primary heat-transfer fluid.

ORGANIZING FOR NUCLEONICS

The GE chemical department will operate Hanford. The GE Research Lab will run the nearby Knolls Lab. The general engineering and consulting laboratory will handle much of the development work for both Hanford and Knolls.

To determine general policy GE President Charles E Wilson has set up a 3-man Nucleonics Committee led by Harry A Winne, vice-president in charge of engineering policy. The other two members are Dr C G Suits, director of the research laboratory, and Dr Zay Jeffries, general manager of the chemical department.

LONG SHOT FOR MONSANTO

Monsanto Chemical Co, AEC's other postwar contractor, is taking a much longer gamble on the atom than GE. Monsanto has to look a lot harder for assurance of eventual profit out of its operation of the Clinton and Dayton laboratories, but will undoubtedly emphasize applications to chemistry and drug production. This field may develop greatly. Dr Charles A Thomas, central research director for Monsanto, will head up the work of Clinton Lab.

Performance Characteristics of Turbine Pumps at 3500 and 1750 Rpm

What is a regenerative turbine pump? How does it operate? How does it differ from a centrifugal? At what speed does it give best performance? Here are the answers to these and other questions by E L Abramson, sales engineer of R E Roth Co

► Because of their simple construction and favorable performance turbine pumps have come into wide use during the last ten years. Among their many applications, they are particularly suited to handling hot water against moderate pressures, such as boiler-feed and condensate-return services employ. They do not vaporbind easily, and operate satisfactorily under comparatively low suction heads; their capacity varies only moderately with considerable change in discharge head.

Pump Construction. Before taking up pump characteristics, let's look at construction. Several rotating-pump designs are classed as turbine types. Those we are considering, however, are regenerative or peripheral pumps, a special centrifugal type. They can develop several times the head of a conventional centrifugal design of equal impeller diameter and operating speed.

Fig. 1 to 3 show cross-sections through one design of turbine pump. Vanes are cut in the impeller rim, Fig. 2, and rotate in an annular channel in the pump's casing. In Fig. 3 fluid flows in at the suction and is picked up by the impeller's vanes. After making practically a complete revolution in the annular channel, fluid attains a high velocity that diverts it out through the pump's discharge.

Pump Operation. Liquid entering a centrifugal pump can pass between the impeller vanes but once, and has energy supplied to it only while traveling the short distance from the impeller's eye to its periphery. In the turbine pump, liquid is recirculated between the impeller's vanes, Fig. 1. Consequently, energy is supplied to the fluid in a number of impulses or impacts by the vanes in their comparatively long travel from suction to discharge nozzles.

These impulses, given to the liquid by a turbine pump's impeller vanes, are comparable to multistaging in conventional centrifugal pumps. In multistage centrifugal pumps, the energy imparted to the fluid is a summation of the energy received from a number of impellers in series. Similarly in a turbine pump, energy imparted to the fluid is a summation of that from a number of turbine blades.

Pressure developed in a turbine pump varies from a minimum at the suction to maximum at discharge. Pressure varies practically uniformly around the periphery, being about one-half discharge value at the midpoint between suction and discharge.

Applications. Turbine pumps are particularly suited to small capacities at medium pressures, such as are required for small- and medium-size-package steam-generating units. They call for feed pumps rated 1 to 60 gpm at pressures up to 200 psi. These conditions can be obtained with 1750- or 3500-rpm pumps. For a given head and discharge, however, the higher the operating speed the smaller the pump and motor unit. This also reduces initial cost, weight and space for installation.

High-Speed Advantages. Reduction in weight and cost is illustrated by two 6-gpm 200-ft-head pumps, which 1-hp motors drive at 3500 and 1750 rpm respectively. The 3500-rpm pump weighs 140 lb, is 25 in. long and 11 in. wide, compared to 200 lb, 30 in. and 12.5 in. for the 1750-rpm unit. List prices for motor and pump are about 25% higher for the lower-speed unit.

Not only does the high-speed pump have the advantages enumerated but it performs better as indicated by the curves in Fig. 4. Near the point of best efficiency and 8 gpm, the high-speed pump is good for 135 ft head, point *A*, where the slower speed one develops

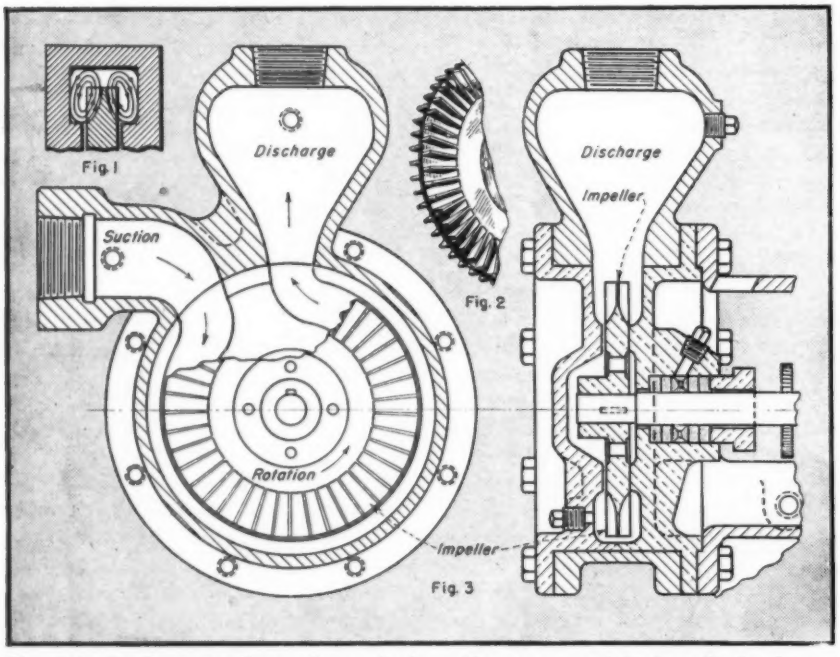


Fig. 1 to 3—Cross-sections of one design. Vanes are cut in impeller's rim, as in Fig. 2 which rotates in annular channel, Fig. 1 and 3, in pump's casing

only 110 ft, point *B*. Efficiency of the 1750-rpm pump is about three points less than that for the higher-speed unit. At 6 gpm, both pumps develop 200-ft head, point *C*, but again efficiency is about 2 points lower for the slower-speed pump, 33 compared to 35.

It is at the higher discharge rates that the slower-speed pump makes its worst showing. At 10 gpm, head and efficiency of the 1750-rpm pump drop to zero where the 3500-rpm pump develops a 70-ft head at 35% efficiency. Therefore, any way that the two pumps may be considered the high-speed one has superior performance.

Pump Characteristics. The turbine pump when throttled has a rising head and power characteristic. At 6 gpm each pump develops 200-ft head and requires less than 1 hp to drive it. On closed discharge their head more than doubles to over 400 ft and power increases to 1.5 hp, a 50% overload on the 1-hp motor normally selected to drive the pumps. For this reason, these pumps should not be used on applications where their discharge is controlled by throttling unless the pumps are overmotored or a bypass with a relief valve is installed in the discharge line.

When comparing 3500- and 1750-rpm turbine pumps, impeller size is of interest. Fig. 5 shows two impellers, one for 3500 and one for 1750 rpm, which develop 200-ft head at 6 gpm and require about equal horsepower. Even though the higher-speed impeller has one half the diameter of the lower-speed one, they both have the same peripheral velocity, 2565 ft per min at the vane tips. Sealing surfaces *A* on the smaller impeller, however, have only about one quarter the area of those on the larger impeller. Therefore, since both pumps have the same clearance between their impeller and casing, clearance space in which fluid can bypass the impeller is about double in the slower-speed impeller what it is in the higher-speed one.

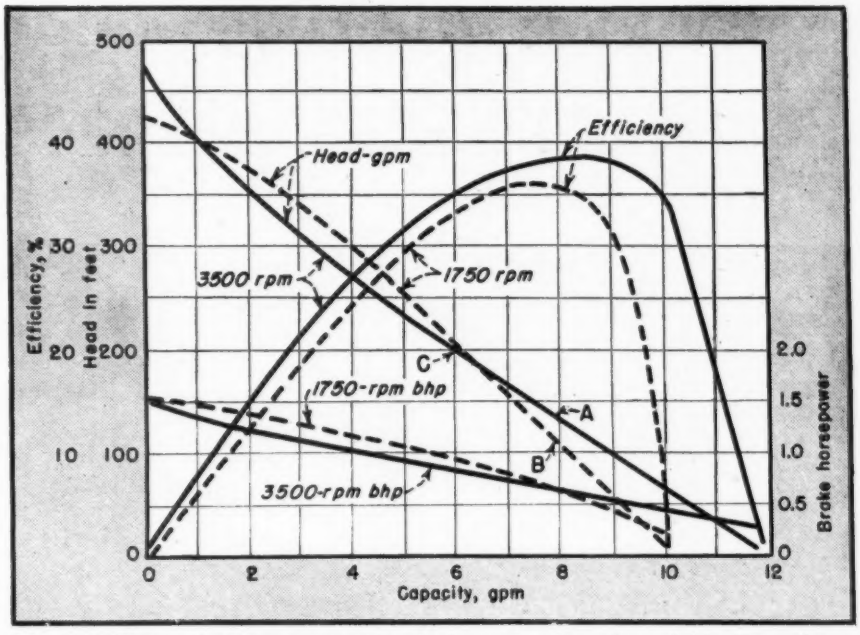


Fig. 4—3500-rpm turbine pump not only has advantage in weight, dimensions, initial cost, but it performs better than the 1750-rpm unit as curves indicate

In clearances *A*, surface areas on impeller and casing exposed to pressure are about four times greater in the 1750-rpm pump than in the 3500. Because pressure conditions are the same for both impellers, fluid-friction losses in the higher-speed pump are considerably less than in the slower-speed one.

These comparisons are based on specified impeller sizes for particular service conditions, but the same relations exist between dimensions of other impellers for other service conditions. A 6-in. diameter impeller is about the maximum for 3500 rpm, which will develop an operating pressure of 350 psi or higher. Capacity limits depend largely on efficiency considerations, but since turbine-pump performance characteristics are desirable for many applications, efficiency may not be a deciding factor when making the pump selection.

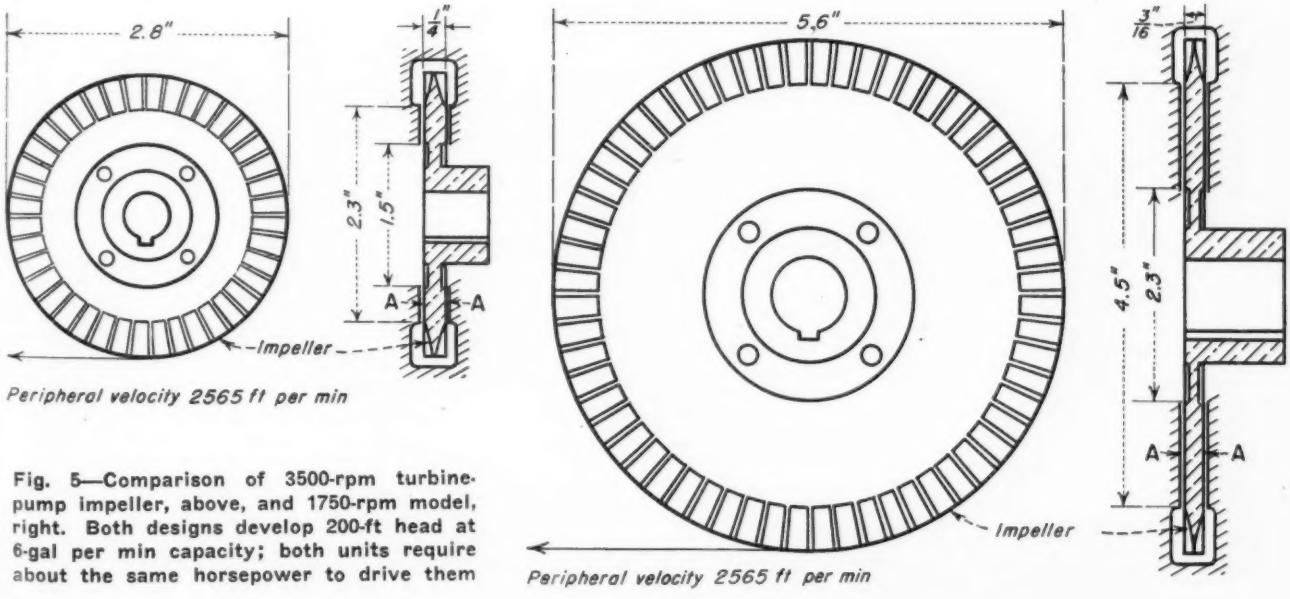


Fig. 5—Comparison of 3500-rpm turbine-pump impeller, above, and 1750-rpm model, right. Both designs develop 200-ft head at 6-gal per min capacity; both units require about the same horsepower to drive them

Houses Heating Boilers on Roof To Keep Valuable Space Marketable

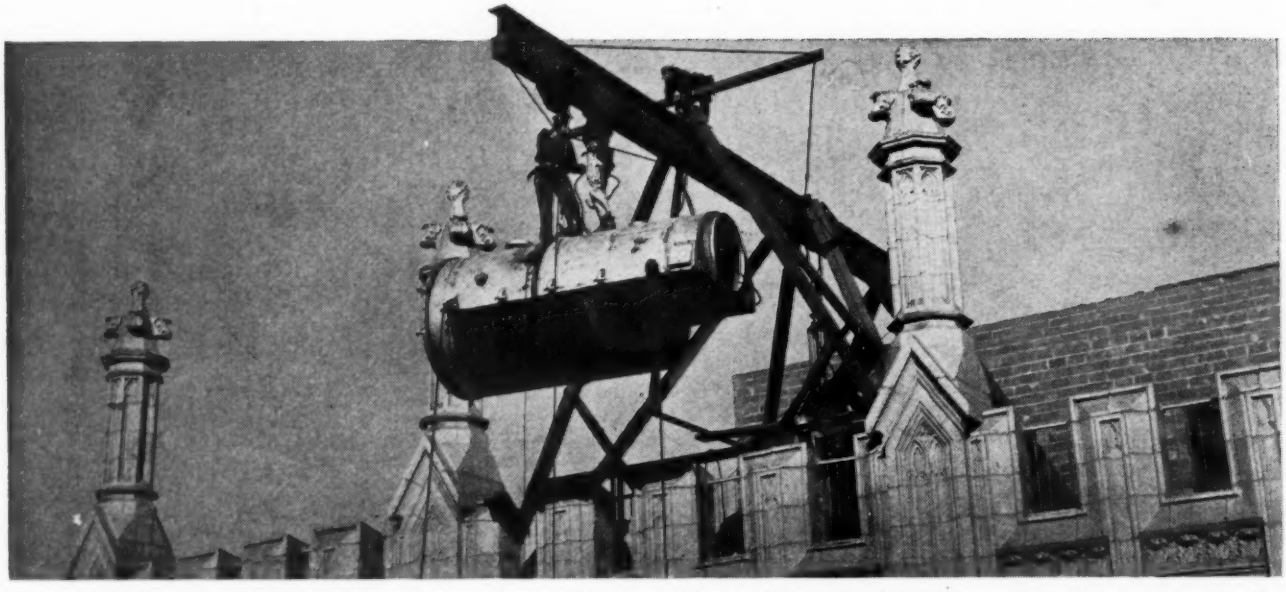


Fig. 1—While the weight and bulk (heaviest part is five tons) are not unusual, the high lift was completed without incident although a stiff wind was blowing while all of the parts were being hoisted to the roof

With basement rented, sub-basement construction impracticable, and no chimney available, ingenious planning and handling achieve a logical high-level low-rental plant for steam, air conditioning

By H B STEGGALL,
Vice-President, United States Radiator Corp.
Pacific Steel Boiler Division

▶ THE 18-STORY KIRBY BUILDING in Dallas, Texas, had depended, since its erection in 1913, on the nearby Adolphus Hotel for electricity and steam for heating. Recently the hotel power plant was displaced so the Kirby management had to look elsewhere for power services. Electricity was available from the local utility but steam for heating presented a difficult problem.

Originally, steam came underground to the building and, except for small amounts taken off in the basement and at fifth-floor level to feed all floors below the sixth, steam was carried to the attic through a riser and distributed to all radiators above the fifth floor through a downfeed system. Condensate drained to the basement.

The five lower floors and basement are occupied by A Harris & Co, fashion center. Since the building has no chimney, and it was impracticable to construct a sub-basement, only one possibility remained: Could the boilers be placed on the roof? Although at first the idea seemed ridiculous a thorough study did not uncover one unsurmountable difficulty.

First fuel choice in the Southwest is natural gas, which was piped to the top of the building without difficulty. Second choice is oil which, if ever used, can also be piped up easily. Condensate return presented no problem. Inspection showed that existing building columns would support the additional weight, but the roof slab would have to be modified slightly.

Roof Modifications. Roof slab is reinforced concrete, which carries a cinder fill and water-proof membrane, topped by a layer of quarry tile. On the portion where a penthouse incloses boilers and air-conditioning equipment, roofing material was removed down to the structural slab, and a concrete floor was laid. Area on which the boilers stand carries a layer of 4-in. hollow tile, placed end to end to provide air-circulating passages, topped with a covering of flat firebrick. Fireproofing was removed from the supporting columns under the slab and additional floor-supporting beams welded in place. The beams were then grouted up to the ceiling and fireproofed.

Greatest apparent difficulty was hoisting the boilers and associated equipment to the roof. Although the weight and bulk of the parts involved are not unusual, when adequate support and guying of hoisting equipment is available, the matter of finding suitable support and guy anchorages on the roof required considerable study because each part had to be hoisted and then swung back over the building.

Answers to this problem were:

(1) Construct a demountable steel A-trestle carrying a 24-in. I-beam protruding 12 ft beyond the building parapet wall. A trolley, equipped with rollers to ride on the beam, supported the hoisting tackle and carried the piece back to the roof after each hoist.

(2) Purchase heating and ventilating

machinery that could be disassembled into parts of low weight. To meet this requirement two 15-psi 1429-sq-ft boilers were selected that could be disassembled into firebox and shell and reassembled in place without a second shop or boiler insurance inspection. Largest piece to be handled was the boiler shell, which weighs 5 tons.

Heating-System Changes. At the time of installing boilers the building heating system was revamped. Old steam-supply riser from basement to attic now becomes the downfeed line to supply the original radiation system, which remains intact in the basement and first five floors. A header installed on the fifth floor connects to original downfeed risers to feed these lower floors.

Condensate drains to a receiver in the basement to which a condensate pump is connected. The latter, controlled by a float switch, returns condensate to the receivers of a pair of boiler-feed pumps in the penthouse. Pumps operate according to change in boiler-water level.

From the sixth floor up, original downfeed and return risers and the cast-iron direct-radiator system were replaced with (1) high-velocity conditioned primary air, supplied through conduit to window units where final tempering takes place, and (2) a dehumidifier unit complete with duct work, grilles and fans to serve the interior areas. Tempering at the window units is accomplished through a 3-zone water system in which the circulating water is heated or cooled according to requirements in each zone. Window units induce room-air circulation in the ratio of 4 cfm of room air to one of primary air.

Cooling System. A motor-driven centrifugal refrigerating compressor with associated water coolers does the cooling job on the circulating water and another set of heat exchangers, supplied with steam from the boilers, takes care of the heating cycle.

Compressor is rated at 350 tons, when cooling 750 gpm of water to 42 F, if the condenser is supplied with 1050 gpm of 85½-F condensing water. Drive is by a wound-rotor induction motor through a speed-increasing gear. Capacity variation is accomplished by changing the motor speed. In addition, the machine is equipped with manual suction control so capacity can be reduced below the lowest value obtained by changing the motor speed. Refrigerating-unit condensing water is cooled in an induced-draft cooling tower made of red wood. Tower is able to cool 1000 gpm of 95.5 F water to 85.5 F when wet-bulb temperature is 78 F. A tunnel leading from an access opening to the water-pan sump permits cleaning it while tower is in operation. The primary air dehumidifier can cool 25,200 cfm of air from 100-F dry bulb, 78-F wet bulb to 49-F wet bulb when supplied with 692 gpm of 42.6-F water.

Conditioning unit serving interior areas, away from the windows, consists of filters, dehumidifying coil and fans for cooling or ventilation, all located in the penthouse. No heat is added to this air because the areas have a cooling load even in winter. Air delivery is through a conventional duct system.

Instead of a chimney, the gas-fired heating boilers use induced-draft fans, which discharge the furnace gas through stacks extending 6 ft above the penthouse roof. Each fan, fitted with ball bearings protected by heat flingers, is designed to handle 3600 cfm of 500 F combustion products.

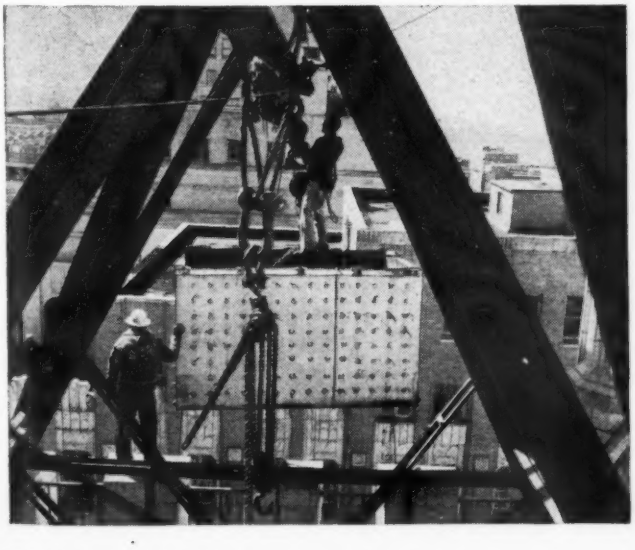
Internal Cleaning. Before placing the system in operation the boilers and tempering-water system will be cleaned as follows: Mix 30 lb of caustic soda with the water in each boiler and fire the unit each day for a week. Then empty, fill with clean water and fire for two hours at 5 psi. Meanwhile supply makeup constantly and blowoff water and steam through a connection on top of the boiler.

Circulating-water system cleaning involves (1) removing the filtering media from filters (2) dissolving 20 lb of caustic soda in the expansion tank and filling the 3-zone lines with water, and (3) heating the water to 180 F and circulating it for 8 hr. Treatment is to be repeated until no oil or sediment shows at the filters after circulating clean heated water for 8 hr.

Zumwalt & Vinther are consulting engineers; Thomas Jameson & Merrill, architects and structural engineers; and Martyn Brothers, Inc, heating and plumbing contractors; all of Dallas.

Fig. 2, right—Lack of usable spots on the roof for support and guying was overcome by erection of a double A-frame whose legs were anchored to the building columns

Fig. 3—Legs of the A-frame were spread wide enough to clear the large parts as the rolling trolley with its load was pulled backward from the position for hoisting



Operating and Design Engineers Compare Notes on Outdoor Plants

History, merits and disadvantages of these stations for industrial and central station service discussed at length. An abstract of a symposium presented by eleven engineers before the spring meeting of ASME at Tulsa, Oklahoma, on March 3, 1947

► WHILE PRIMARY INCENTIVE for outdoor-design selection comes from reduction in structural costs, this advantage is offset somewhat by increased costs to weatherproof exposed equipment and to carry on construction and maintenance under inclement conditions. Each contemplated new outdoor plant must be carefully analyzed in respect to climate, fuel and over-all generating costs to realize such other advantages as (1) plant-expansion flexibility (2) better ventilation (3) increased cleanliness (4) smaller operating force.

These and other pertinent facts were emphasized by a panel of eleven engineers discussing the subject and representing plant designers, for the utilities and industry, and the equipment manufacturers. Sitting in this panel were: A R Smith, General Electric Co; F S Clark, Stone & Webster Engrg Corp; F B Fairchild, Public Service Electric & Gas Co; F X Gilg, Babcock & Wilcox Co; O H Hedrich, Public Service Dept, City of Glendale, Calif; C A Heinze, consulting engineer, Los Angeles, Calif; H G Hiebeler, Houston Lighting & Power Co; F M Leverett, The Texas Co; R T Matthews, E I du Pont de Nemours & Co; J R Carlson, Westinghouse Electric Corp; E D St John, Kansas Gas & Electric Co. Highlights of each member's discussion follow:

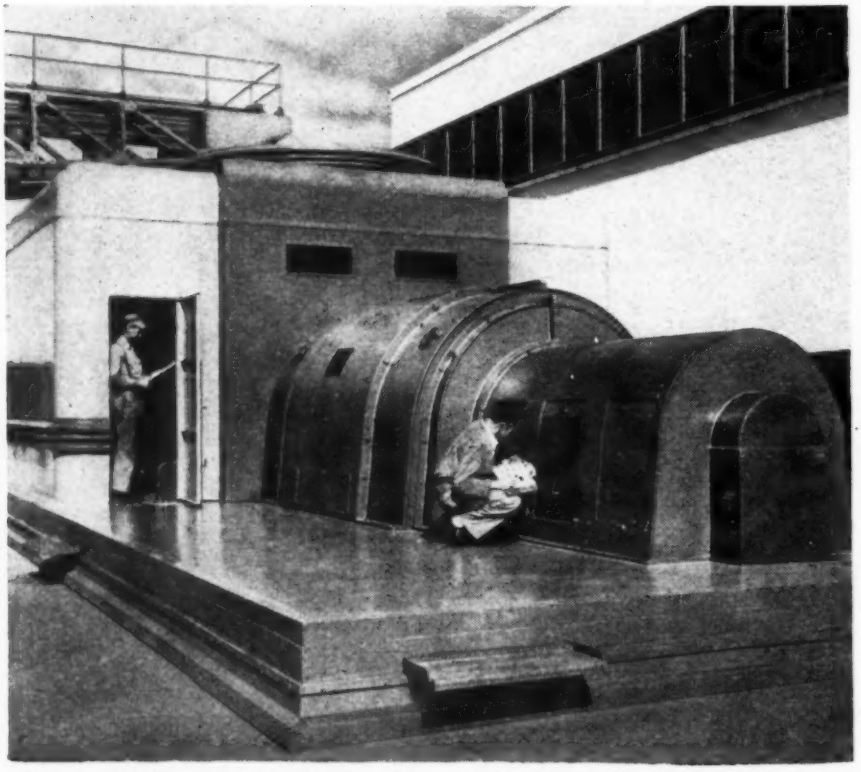


Fig. 1—10,000-kw 650-psig 825-F outdoor turbine-generator unit in municipal plant of Burbank, Calif. Metal housing incloses turbine and its operating board

A R Smith. Because of shortage of structural materials and ideal weather in Chile, the Bethlehem Steel Co built during 1915 a steam-electric plant with the boilers outdoors. The oil-burner fronts formed a part of the turbine-room wall. Before this installation it had been common practice for steel companies to locate boilers out-of-doors.

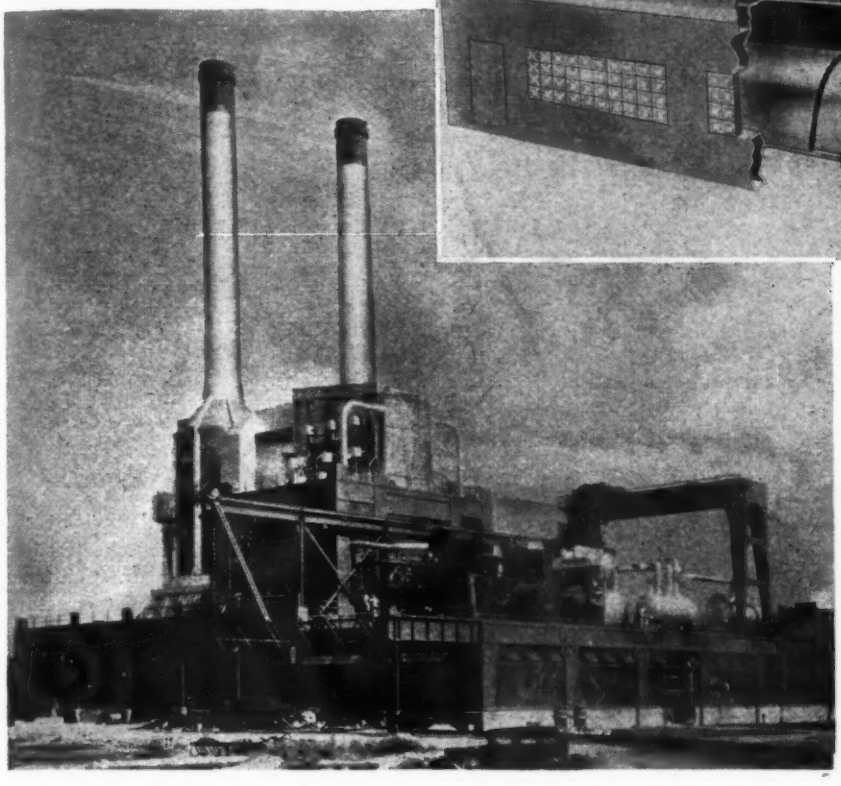
When the GE mercury plant was built at Schenectady the superstructure was kept to a minimum because of the extreme difficulty in making adequate structural allowances for future plant extensions. The turbine-generator being completely sealed needs no protection. Its reliability has reduced the frequency of internal inspection and incidental repair to between once a year and once in two years. Protection must be provided for the machine and men during new construction, repairs and overhaul. This can be done by a temporary structure of canvas sheets supported by pipe frames, which can be erected or removed in a few hours and stored in a small space. The canvas top should roll back to enable using the crane.

Most boiler repairs are made within the casing, which may be considered a sort of building. The mercury boiler has a brief housing around it because operating requirements were not fully known at the time of construction. Savings are not only realized by elimination of most of the superstructure but also because of the reduction in size of footings for the walls. This installation is now to be doubled in size in accordance with the present design.

O H Hedrich. Reasons leading to semi-outdoor construction of the Glendale steam-electric plant were (1) estimated building savings of $75,000, or 5% of total plant cost (2) mild climate (3) elimination of certain building maintenance and outdoor labor costs.

The comparatively large building-cost reduction resulted from eliminating a heavily constructed turbine room with-

Fig. 2, below—Outdoor mercury-steam-electric power station at Schenectady, N. Y. Mercury-turbine unit and condenser-boiler at left of gantry crane



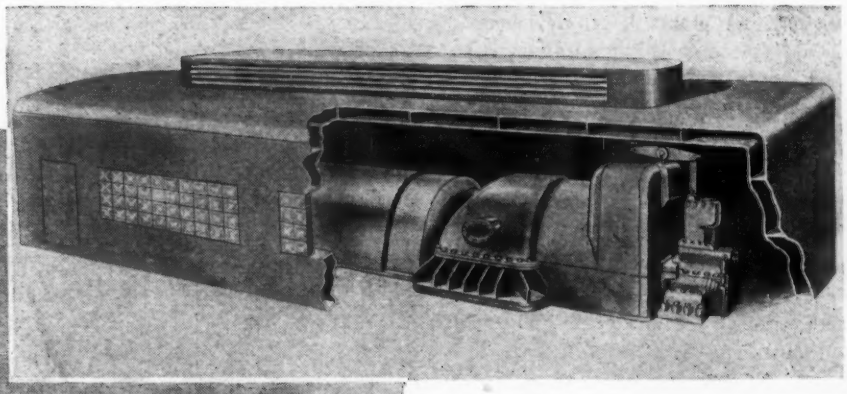


Fig. 3, above—Proposed arrangement of providing removable housing over an indoor-type turbine-generator unit.

out interval bracing, capable of supporting a 5-ton 47-ft-span bridge crane and able to withstand earthquake shocks.

Inclosing the boilers with their auxiliaries (excepting the induced-draft fans) was a relatively inexpensive addition to the necessary inclosure of the firing aisle, control room and offices. This was particularly true because the housing eliminated the considerable cost of weatherproofing the boilers. Another factor favoring the housing was the improvement in architectural appearance of the plant.

The first unit was installed during the winter of 1940-1, the most disadvantageous season for erection. It was necessary to rig some large tarpaulins over the turbine to shed rain, but despite this expense the erection cost was not materially increased.

The first 600-psig 825-F 20,000-kw unit has been operating six years and no particular operating disadvantage has appeared because of the outdoor feature. A second unit is now being installed, initial operation being scheduled for July 1947. Both turbine-generators are supplied by three 200,000-lb-per-hr steam generators. The same semi-outdoor design is being followed because of the financial advantage in capital and operating costs.

F M Leverett. The first outdoor power-type boiler was installed by The Texas Co at Port Arthur, Texas, in 1935 alongside existing outdoor tubular-type oil heaters used in the refining process. The 475-psig 28,000-lb-per-hr boiler is completely inclosed in a steel shell and the feedwater pumps housed in a small building at the boiler rear. This installation has proved entirely satisfactory.

In the latter part of 1939 three outdoor boilers were placed in service, each rated at 675 psig, 700 F, 300,000 lb per hr. These units are entirely outdoors including air preheaters and f-d and i-d fans. Boiler fronts form one wall of the firing room, which houses the feedwater pumps, fuel pumps, control instruments and other miscellaneous auxiliaries. Blowdown drums, high-stage water heaters, feedwater lines and controls are on the roof of this building. Boilers are designed to be fired with either natural gas or fuel oil, with provisions for the addition of pulverized coke. Furnaces are completely inclosed in a weatherproof steel shell to insure adequate protection.

During the first winter of operation the temperature dropped to 12 F and remained well below freezing for several days. Considerable trouble developed from freezing of control lines to the feedwater regulators, draft controls, etc, and it was necessary to steam trace and insulate some of these lines exposed to the weather. With these precautions no further troubles developed in seven years of operation, which was entirely satisfactory.

During 1942 and 1943 two identical steam generators were added making a total of five. The turbine-generators of this plant are entirely housed. We question the placing of these units outdoors in a damp climate in view of our experience with outdoor motors at this location.

R T Matthews. To make the outdoor plant worth-while to industrial engineers the initial reduction in investment must more than offset the additional operating and maintenance problems and costs, personnel problems and the inherent risk of less dependable service.

Factors requiring careful consideration are: (1) climatic conditions (2) type of fuel and firing equipment (3) fuel cost (4) installation—new, extension or modernization (5) architecture (6) construction materials (7) safety standards (8) personnel policy regarding working conditions (9) relative cost of steam and power in finished product (10) value of reliability (11) maintenance (12) additional costs of outdoor equipment (13) operating costs of outdoor equipment (14) land cost (15) saving over indoor design.

Effect of these factors is illustrated in Table II for eight plants from semi-tropical southern Texas to the Canadian border, where there are long, cold win-

ters. These plants have all been designed by the same organization. Outdoor equipment maintenance in chemical works is more expensive because all steel must be painted frequently. Heat insulation has to be repaired and weatherproofing paints applied about every three years.

Because no spare boilers and turbines are provided power-plant shutdowns for maintenance must coincide with process shutdowns and not with optimum weather conditions. This points to much higher maintenance costs for outdoor plants.

A 125,000-lb-per-hr pulverized-coal industrial boiler plant will cost around $1,000,000. Building and coal-bunker structures should cost between $125,000 and $150,000. By locating equipment outdoors, about 25% of the building cost could be saved, or $31,000 to $37,500. If one more man per shift is required by placing equipment outdoors this saving will be questionable. Also if fuel costs 25 cents per 10^6 Btu and the outdoor boiler suffers a loss of 2% in efficiency because of less careful attention the investment saving will be offset in about five years.

Additional cost of a steel-encased boiler for outdoor installation is about 1½ to 3% more for industrial sizes. Auxiliary equipment appears to cost the same for either service but where temperatures drop very low, outdoor installation is not recommended by manufacturers. In an industrial plant it is questionable whether the cost of a gantry crane, the smaller housing or extra insulation and the roof deck around the outdoor turbine-generator represents a worth-while saving compared to an indoor installation. It is even more doubtful whether this saving makes up for the crowded operating space around the unit and the impracticability of removing the inclosure for major repairs and exposing turbine bearings, governor and valve controls to weather and dust. One manufacturer estimates additional weatherproofing costs from $8,500 to $11,000 for units of 2000 to 7500 kw.

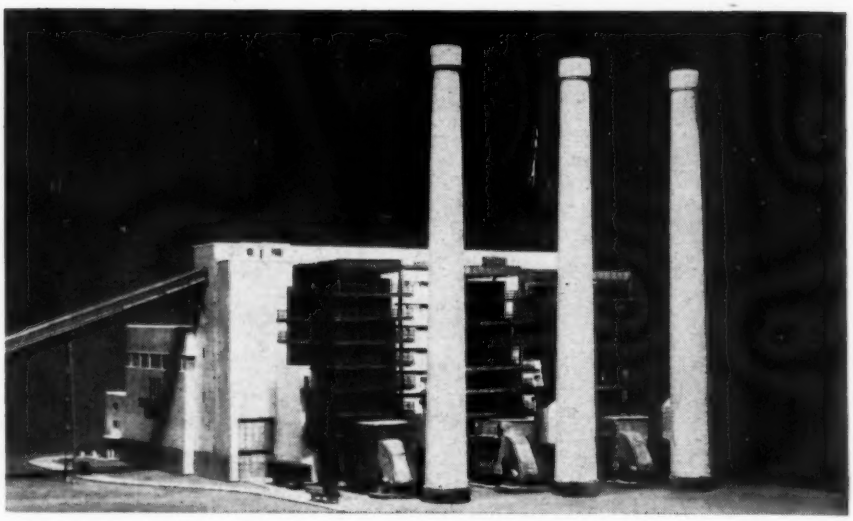


Fig. 4—Model of new Sewaren plant, Public Service Electric & Gas Co. shows arrangement of semi-outdoor boilers, with fans, air heaters and precipitators

E D St. John. The Ripley plant of Kansas Gas & Electric Co has two 160,000-lb-per-hr integral-furnace-type 650-psig 825-F steam generators, feeding a 28,750-kva turbine-generator. Gas firing is supplemented by oil standby. Condensing water recirculates through a forced-draft cooling tower.

A compact low-head brick structure houses the turbine, Fig. 8, while the outdoor boilers are roofed with a self-supporting canopy. Firing aisle between boiler and turbine room and the one between boilers are both inclosed. F-d and i-d fans and air preheaters are outdoors at the boiler rear. Construction savings in building structure amounted to about $150,000.

The plant went in service in July 1938 and no trouble developed until the first cold spell when the air-operated damper controls froze. This was remedied by inclosing these controls in small insulated cabinets and providing strip heaters controlled by thermostats. It was also necessary to protect the cooling water on the i-d fan bearings. Items of this nature were expected with cold weather since protection had been purposely omitted during construction.

Additional ventilation is provided for the building and basement during the summer by installing a short duct on the suction of one of the f-d fans and arranging it so air can be taken either from indoors or outdoors.

On only one occasion since this plant began operating has it been necessary to change a fan bearing in real cold weather. With a suitable maintenance schedule the possibility of failures

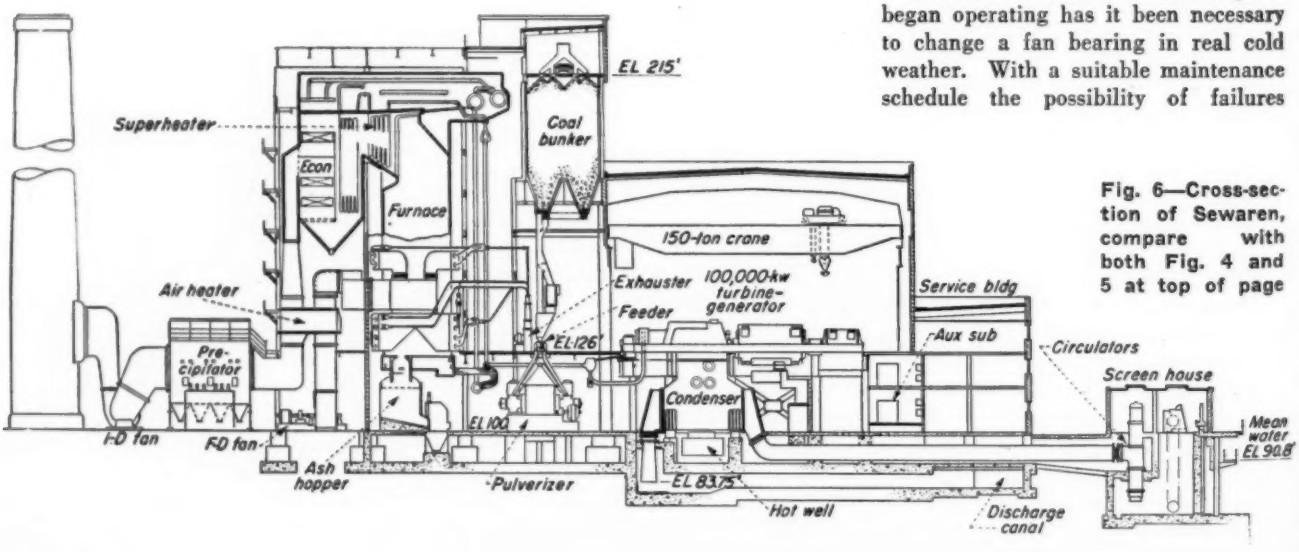


Fig. 6—Cross-section of Sewaren, compare with both Fig. 4 and 5 at top of page

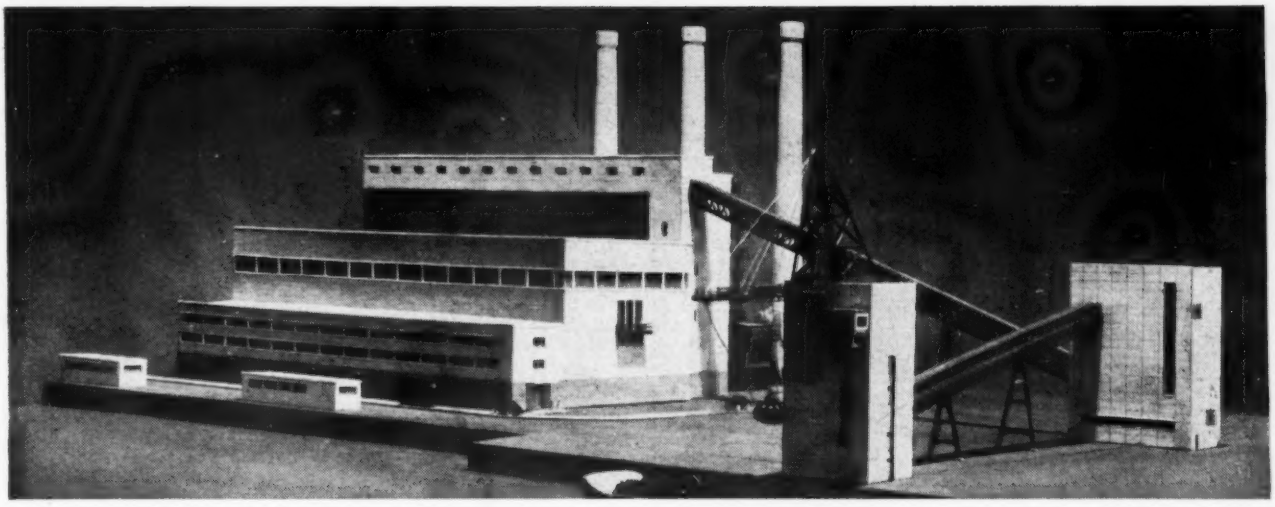


Fig. 5—Another view of the Sewaren plant model shows the service building at front with lowest roof, then turbine room, and the highest section housing coal-handling equipment and firing aisle. Boilers are in the rear of building

during adverse weather is remote. There has been very little complaint from the operators regarding working conditions. They do not like going outdoors from a heated inclosure in the winter, but find it pleasanter in mild weather. Most operators prefer a fully inclosed plant.

There has been no noticeable increase in boiler maintenance attributable to the outdoor features. A 30,000-kw extension is scheduled to go into service in Nov 1948 and will have the same general design as the existing unit.

F B Fairchild. Outdoor equipment is used in the 50,000-kw superposed unit at the Essex station, Public Service Electric & Gas Co., installed in 1938. With f-d and i-d fans, precipitators and air heaters outdoors above the roof this unit has proved entirely satisfactory.

The new plant at Sewaren, N. J., Fig. 4, 5 and 6, extends this idea to the economizer and parts of the boiler proper. About 50% of the boiler heat-radiating surfaces and its auxiliaries will be outdoors. Advantages of this design are (1) adequate ventilation at reasonable cost (2) increased cleanliness by supplying filtered air under a slight pressure (3) reduced investment cost. Capital savings are offset somewhat by a fraction-of-a-percent lower boiler efficiency, and higher painting and maintenance costs for the exposed equipment. It was thought that totally inclosed motor drives should be used even with an indoor installation because of failures of open types from dirt, heat and an occasional boiler-tube rupture filling the upper part of boiler room with steam.

Boiler drums are in the building above the operating aisle, which protects gages, safety valves and drum access from inclement weather. Boiler bottoms will be inclosed, protecting mud drums and blowdown connections. Bearings as well as hydraulic couplings on outdoor equipment will use air for cooling, eliminating piping of water outdoors. Arrangements will be made to keep boiler interiors warm during winter emergency shutdowns for maintenance work and to prevent freezing the nondrainable superheaters.

C A Heinze. The only reason for the high building inclosing the conventional turbine is to provide height for a traveling crane to carry its loads over other equipment. In designing the Glendale and Burbank plants the original aim was to build outdoor plants. Studies led to the semi-outdoor type, however, with all equipment housed or covered by a roof with the exception of the main turbine units, Fig. 1. These have a metal inclosure separated from the main building with room enough inside for inspection and operation. Generators and exciters are protected by weatherproof housings. Glendale has a gantry crane supported on each side of the turbine, while Burbank has a cantilever type. These cranes are supported by the ground, thus relieving the building structures of all forces they exert.

Semi-outdoor advantages are: (1) Increased costs for buildings to withstand earthquake disturbances are avoided. (2) Six months of rain-free weather per year allows planned major overhauls on outdoor equipment. (3) Modern architecture is more easily realized with outdoor design. (4) Stability and reliability are the same indoors and outdoors. (5) Natural-gas and oil fuels eliminate conspicuous coal-storage and handling systems.

Each of these factors has contributed to realizing highly satisfactory operation. Additions now being contemplated at each of these plants will follow the present general design. Savings can amount to as much as 35% of the building costs of an indoor installation. Compared with an indoor plant there is no difference in fuel and general maintenance costs. At times maintenance may have to be done during inclement weather, taking more time with higher cost. Such increment cost is counterbalanced by a reduction in building repairs, but in any event they are not large items.

Semi-outdoor plants being simpler and more compact than indoor types lend themselves to smaller operating forces.

F X Gilg. With the structure properly painted to resist rusting, snow and rain cannot harm a boiler unit sealed with an air-tight closure provided water cannot collect in pools. It is necessary to avoid flanged horizontal panels, buckstays or other steel conditions that collect water faster than it can drain off. Where a steel casing is not used it is only necessary to protect the insulation with a weather-proofing compound.

In mild climates boiler mountings can set outdoors without much danger of deterioration, although there is some preference for housing gage glasses. Safety valves should have greater lee-

TABLE I—SUPERSTRUCTURE INVESTMENT FOR INDOOR STEAM-ELECTRIC PLANTS

Station	No. of units	Kilowatt capacity	Building Investment Cost % total cost	$ per kw
New Bedford	8	92,500	16.60	.....
Buffalo	4	95,000	26.65	.....
Kokomo	3	12,000	28.20	35.91
Montaup	2	70,000	17.49	.....
Indiana Electric	3	75,000	22.46	.....
Long Beach No. 2	3	135,000	20.45	14.76
Long Beach No. 3	2	200,000	18.55	11.13
Edgar	6	167,000	19.96	.....
Neches	3	80,000	18.51	.....
Norfolk	1	30,000	18.51	.....
Richmond	2	52,500	13.39	11.00
Shuffleton	2	70,000	21.50	16.43
El Paso	2	40,000	19.80	12.80
Bennings	3	90,000	13.49	10.54
Buzzard Pt.	2	70,000	16.90	10.12
Lynn	1	26,500	21.02	21.47
Baton Rouge	5	75,000	18.55	.....
Totals & Avgs	52	1,380,500	19.30	15.00

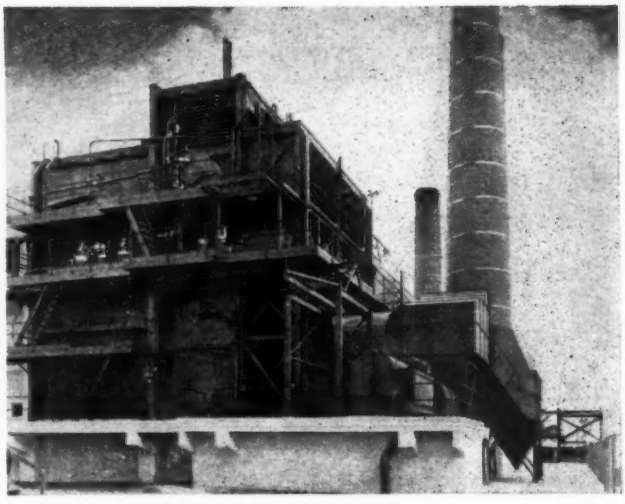


Fig. 7—Outdoor 300,000 lb-per-hr steam-generating unit; operating front at left forms part of turbine-room wall

way between closing and operating pressure to avoid simmering under sudden temperature changes. Steam-gage, drain, metering and automatic-control lines must be indoors or protected from freezing in more severe climates.

Temporary protection should be provided for erection personnel where needed. A rainy spell will slow up outdoor erection to almost a standstill. In severe cold it would be inconsiderate to expect men to work on units in the open. At best erection costs will mount.

Operators and maintenance men cannot be expected to do good work when exposed to bad weather. They have to be protected by providing inclosed platforms and walkways to working areas. Even in milder climates, the operating instruments and panelboard are sheltered so operators are indoors even though the boiler is outdoors. Most of the recent outdoor installations have been arranged so the boiler front wall with its burners, controls, water column, steam gage, meters and control equipment are indoors.

J R Carlson. New ideas lead to means of simplifying certain things dictated by custom. For instance, gantry cranes are rarely used indoors but are universally accepted in outdoor plants. In addition, the drive for economy leads to eliminating unessential accessories in the power plant.

By providing two half-size condensers located alongside the turbine, Fig. 9, a material reduction in foundation height results. The main condensers can serve as a foundation for low-pressure heaters and air ejectors, thus simplifying condensate drain and vent piping.

One method of weatherproofing turbine-generators is to take a conventional unit and inclose it in a removable housing, Fig. 3. Another way is to weatherproof the entire unit eliminating the small housing entirely, Fig. 9. Cost of such adaptation adds about 4% above a unit built for indoor service. Equipment erection takes longer, therefore costing more; inspection and maintenance programs are lengthened since they depend on the weather.

H G Hiebeler. At 1943 costs, savings from reduced housing, at the West Junction station of the Houston Lighting and Power Co., are estimated to be of the order of $6 per kw. In this

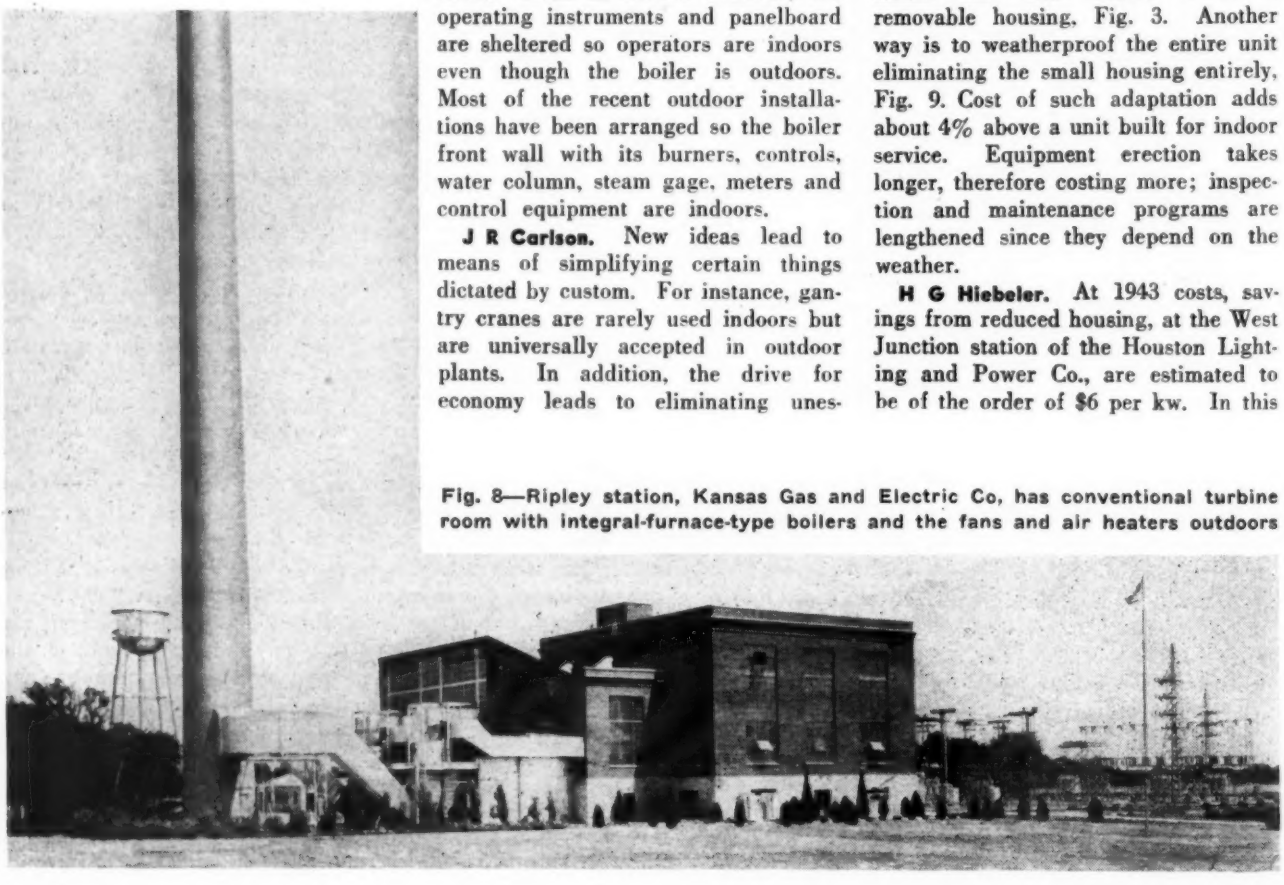


Fig. 8—Ripley station, Kansas Gas and Electric Co, has conventional turbine room with integral-furnace-type boilers and the fans and air heaters outdoors

station the boilers are outdoors with the fans, well- and service-water pumps. In the new section under construction the circulator has also been placed outside. The turbine inclosure is a light-steel, sectionally removable housing. The basement at ground level houses the feed pumps and other auxiliaries. It is completely walled up to the turbine deck.

For the Greens Bayou station now in preliminary design only minimum housing is planned. The two 40,000-(or 60,000) kw turbine-generators will have no housing except over the exciter and perhaps over the front end controlling mechanism. There will be two condensers per unit offset to the side. Basement will be only about 16 ft in height and open on all sides, sheltered only by the turbine pedestal and other structure above. It is estimated that the outdoor features of this design will add another $5 or $6 per kw saving above the semi-outdoor West Junction arrangement.

The Gable Street outdoor plant has operated through two tropical storms. The West Junction plant experienced one, which occurred a few months after initial operation; the station ran until storm conditions reduced load to a very low point when the unit was taken off rather than chance emergency conditions with a new crew.

Maintenance men find outdoor installations cooler and less crowded. In cold or rainy weather a tarpaulin is stretched for temporary shelter. They are not enthusiastic about conditions surrounding turbine repairs; removing roof sections and storing them on a tight turbine deck complicates the work.

Operating personnel prefer the outdoor plants to the older stations because they are simpler and cooler. The operating staff at West Junction comprises only 15 men. Normal shift force consists of an engineer, fireman and auxiliary operator. The 40,000-kw unit was once tripped off the line

(*Continued on page* 152)

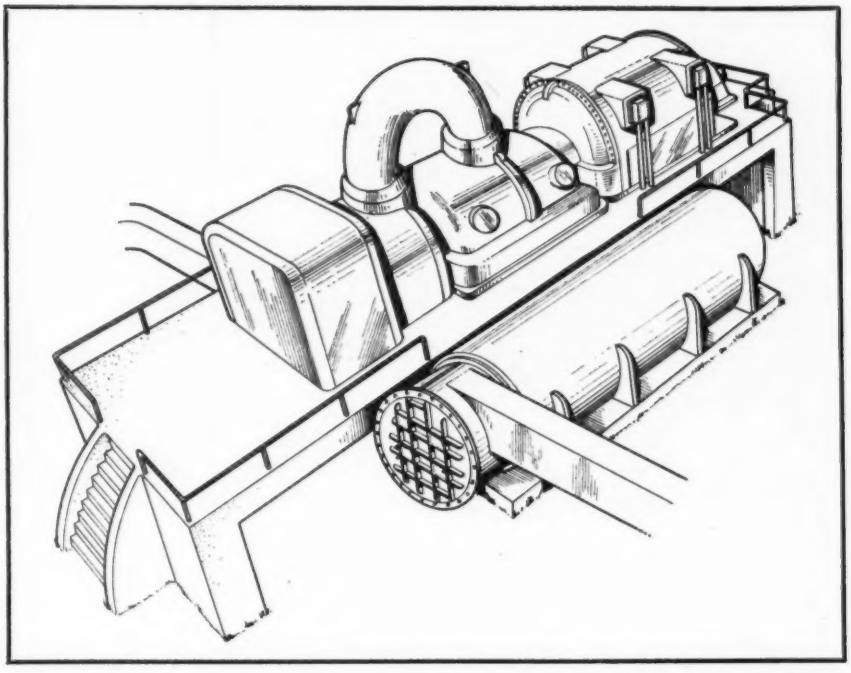


Fig. 9—Design of outdoor turbine-generator, entirely weatherproofed, provided with two half-size condensers mounted at sides, reduces height of foundation

TABLE II—COMPARISON OF INDUSTRIAL PLANT DESIGN AND GEOGRAPHICAL LOCATION

Plant location	*Orange, Texas*	*Houston, Texas*	*Chatt., Tenn.*	*Parkersburg, W. Va.*	*Waynesboro, Va.*	*Richmond, Virginia*	*Wilmington, Del.*	*Niagara Falls, N. Y.*
Installation date	1946	1946	1948	1947	1947	1948	1947	1948
Days/yr below 32F	1	1	58	98	80	106	67	116
Avg min temp, F	45.3	45.5	29.4	20.7	24.2	27.7	25.4	8.9
New plant or addition	New	New	New	New	Addition	Addition	Addition	New
New turbine capacity, kw	2-2500 2-5000	None	None	None	1-3000	None	None	None
New boilers, lb/hr	5-150,000	1-60,000	2-50,000	2-50,000	1-120,000	1-120,000	1-80,000	1-125,000
Fuel, firing	Nat gas	Nat gas	Nat gas and oil	Spreader stoker	Pulverized coal	Pulverized coal	Oil	Pulverized coal
Building design	Semi-outdoor	Semi-outdoor	Semi-outdoor	Largely indoor	Indoor	Indoor	Indoor	Indoor
Equipment located outdoors	Boilers, fans & turbine drives, deaerator, water softener	Boiler, fans & turbine drive, bf pumps, deaerator, water softener	Boiler, fans & turbine drive	Fans & turbine drives, dust collector, deaerator, water softener	Dust collector	None	Water softener	Air heater, dust collector, steam header
Manufacturing building type	Semi-outdoor	Semi-outdoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
Relative fuel cost (incl coal hdlg)	1.00	1.00	3.13	2.83	3.43	3.57	3.91	3.68
Estimated saving in building cost	$50,000	$16,000	.....	$25,000	.....	.....	.....	$8,000
Saving, $ per lb per hr	0.067	0.267	.....	0.25	.....	.....	.....	0.064

India Stakes Her Economic Future on Hydroelectric Developments

Many India governments plan to build dams on rivers in rugged terrain like this to store monsoon rains. Projects will prevent floods, and provide water to generate power and irrigate millions of acres. *Photo by British Combine*

Several large projects are in operation, many others mapped out, some of TVA proportions, to use the destructive floods caused by monsoon rains. Here's how the nation will generate hydro power for industry and irrigate millions of acres to increase scanty food supplies, as told by J K Van Denburg Jr

▶ HIGH ON THE LIST of aims set forth by the new Interim Government is development of huge hydroelectric projects to harness India's summer monsoon rains for industrial uses and to supply controlled water to her parched lands.

Large Hydro Resources. No authoritative survey of India's hydro-power sites has been completed, but recent estimates place her resources at roughly 27,000,000 hp. Even at minimum stream flow the power possibilities are large. The problem of converting this potential power to economic uses gets much attention from both the Central and Provincial Governments. In addition, it is a major item in the plans of the Princely States whose affairs are outside the jurisdiction of these two authorities.

The Central Government already has given top priority to the three largest schemes—all multi-purpose developments—which eventually will supply an estimated 1,500,000 kw of electrical energy, besides extending irrigation to about 3,500,000 acres of land that will add 2,000,000 tons to the country's food supply.

All these projects are in the planning stage, although in some cases extensive soil tests, subsurface explorations and surveys of available construction materials have been completed and preliminary work begun.

Meanwhile, the Central Technical Power Board is handling the major planning role. Set up in 1944, it is engaged in surveys for a total of twelve projects. Its function is to represent the Central Government in making its services available to all levels of government in planning or surveying the possibilities for developing electric power, whether hydro or thermal. So far, of the six reports the Board has submitted, the government has released one, covering preliminaries to the Damodar Valley project.

Three Major Projects. All of these three major hydro projects are in Eastern India. Damodar Valley, the largest, calls for seven dams. The largest individual project is on the Kosi River on the border between the Bihar Province and the Independent Kingdom of Nepal. Standing 750 ft high, the main dam is to be the world's

highest. A third development, proposed for the Mahanadi River in the State of Orissa, will have three dams.

Damodar Valley project is modeled to a degree after the TVA. Its seven dams across the Damodar River and its tributaries will have a total installed capacity of about 200,000 kw, plus 150,000 kw of steam plants supplied from the Bihar coal fields. This project, it is estimated, will cost more than $165,000,000 and take ten years to complete.

BARAKAR RIVER DAM

Sites for the first three dams have been surveyed by Indian Army Engineering crews. The Maithon Dam on the Barakar River is about seven miles above its junction with the Damodar. The plant will have 40,000-kw installed capacity and the reservoir extend 15 miles up the river with 7 miles maximum width.

Second of the first three dams will be at Aiyar on the Damodar 35 miles above the Damodar-Barakar confluence. It is to be constructed largely of rock fill and be 220 ft high and 4.75 miles long, contain about 15,000,000 cu yd of rock, and be faced either with a clay blanket or flexible concrete. Its reservoir will be comparable in area to Maithon, but deeper.

The third dam on the Damodar was to be at Sanolapur, four miles above the junction with the Barakar. Engineers in charge of the Damodar Valley multi-purpose hydro project have, however, abandoned plans for constructing a 5-mile dam at Sanolapur after bitter protests from coal mining interests that it would result in the flooding of large coal deposits. A new site is being surveyed farther down the Damodar.

When completed, the Damodar Valley project, besides being a large source of industrial power, is expected to provide irrigation for 800,000 acres of farm land and control seasonal floods that have long ravaged that section.

Kosi River Project. Although it will consist of only one large dam, the Kosi River project will have an even greater effect on the Nepal-Bihar border countryside. In the two countries it will reclaim about 3000 sq miles, which have been ruined by flood-time wanderings of the Kosi, and will irrigate over 3,000,000 acres of land, improve navigation and produce 1,000,000 kw of cheap power.

The dam itself will be constructed across the Chhatra Gorge in Nepal. Behind its 750-ft face will be stored 10,600,000 acre-ft of water, of which the bottom 2,400,000 acre-ft will be dead storage to provide for silting and for the minimum effective head that can be used for power generation.

Farther down the Kosi, below where it enters the plains, a dam will control the river channel and divert water into navigation locks. Two canals will take off water for irrigation purposes. Still farther down the river a similar dam is to be constructed.

The entire project should be completed in ten years at a cost of $150,000,000. In addition to its power generation the project is expected to produce $15,000,000 annually in food crops.

Mahanadi River Project. Third major project on the Mahanadi River is still under consideration. The Orrisa provincial government has not completed arrangements for financing, and survey work is still going on. Studies indicate, however, that three dams should be built, the first at Hirakud near Sambalpur, which would cost some $48,000,000, irrigate 800,000 acres of land and produce 50,000 kw. The three dams have been estimated to cost $160,000,000, but completion of plans may alter this figure.

A 600-ft dam at Manora on the Nayar River (tributary of the Ganges) would impound about 1,400,000 acre-ft of monsoon rains. Engineers are engaged in diamond-core drilling at the proposed dam site.

Surveys are being made for a dam on the Rihand in Rewa State. Studies indicate about 300,000 kw could be generated at this dam to cost $60,000,000.

A dam across the Thungabadra River in Mysore State would generate 17,000 kw, irrigate 160,000 acres and cost $27,000,000.

A double-purpose project, consisting of a dam 125 ft high across the More River in Bengal, would store 800,000 acre-ft of water and produce maximum of 4000 kw.

A 3-purpose project at the Rohri Canal Falls near Sukkur in Sind province will consist of a 10,000-kw plant, followed by a 7500-kw plant and later by a 5000-kw plant. All will draw on the falls for their power.

A $22,500,000 dam and plant is to be built on the Machkund River between the provinces of Madras and Orrisa. About 100,000 kw is expected to be generated at the conclusion of the 6-year construction job.

In planning the Bhakra Dam on the Sutlej river in the Punjab, in Northern India, the Punjab Government has called in J L Savage, the famous American designer of dams. The provincial government also plans another project at Nangal in the same section, which ultimately is expected to produce 65,000 kw and in its early stages provide about 10,000 kw for use in constructing the Bhakra Dam.

Jaipur State in Rajputana plans, across the Banas River, a $12,000,000 hydro and irrigation dam, which would produce a maximum of 11,000 kw and have other benefits.

Outstanding result of the projects outlined above will probably be a shift in the centers of Indian industry. At present Bombay and Ahmedabad, in Bombay Province, are among India's key industrial spots, being the home of roughly half of India's textile mills. Bombay itself draws its power from the three stations of the Tato Hydro Electric Agencies, Ltd, whose stations, in the small mountain range about 100 miles inland, have a combined installed capacity of 231,000 kw and are at present India's largest. Ten other hydroelectric projects have 338,000 kw installed capacity.

SOME OF MANY HYDRO-POWER AND IRRIGATION PROJECTS PROPOSED FOR DEVELOPMENT IN INDIA

Proposed project	River	Dam: Length, ft	Dam: Height, ft	Power, kw	Res. capacity acre-feet	Estimated cost*
Maithon	Barakar	10,000	160	40,000	1,000,000	$165,000,000
Aiyar	Damodar	23,000	220	.....	1,250,000	
Sanolapur	Damodar	25,000	100	.....	1,500,000	
Chhatra	Kosi	.....	750	1,000,000	10,600,000	.....
Hirakud	Mahanadi	.....	...	50,000	.....	48,000,000
Manora	Nayar	.....	600	.....	1,400,000	.....
Rewa	Rihand	.....	...	300,000	.....	60,000,000
Mysore	Thungabadra	.....	...	17,000	.....	27,000,000
Bengal	More	.....	125	4,000	800,000	.....
Sukkur	Rohri	.....	...	22,500	.....	.....
Madras and Orrisa	Machkund	.....	...	100,000	.....	22,500,000
Bhakra	Sutlej	.....	...	.....	.....	.....
Nangal	Sutlej	.....	...	65,000	.....	.....
Rajputana	Banas	.....	...	11,000	.....	12,000,000

* In some of these projects irrigation costs are included with power-development costs.

Metal Spray Reconditions Plug Valves for Longer Life

Leaking valves waste money and give a plant an unsightly appearance. Question is whether to repair the bad valve or install a new one. Here is how one plant engineer solves valve-maintenance problems by building up worn areas of costly parts

BY B L BAILIE
Plant Engineer, Hiram Walker & Sons, Inc.

▶ AFTER THREE YEARS of continuous operation, we faced the prospect of either replacing or reconditioning our 6- and 8-in. malt and meal plug cocks. These valves control the grain supply to each of eight 13,000-gal cookers. After water is added the entire mass is cooked at a temperature of 280 F. Throughout the cooking each batch is stirred to prevent burning. As a result of this stirring and boiling, fine particles splash against the inside of the cocks and adhere to the exposed metal surface of plug and body. Both the raw and cooked grains are abrasive and after 15 to 18 months' service the valves require reconditioning.

One may not be impressed with the idea of size when 6- and 8-in. rotating plug-cock valves are mentioned, but these units are large and heavy. The 8-in. valve, complete, weighs 526 lb. The plug with its steel stem weighs 191 lb; yoke and brass nut, 59 lb. Prewar cost of one unit was $427.00, whereas total cost of machining, spraying and grinding it averages $117.36. The difference means a saving of $309.64.

Repair Process. Spraying metal is a simple process, but successful application requires extreme care in preparing the surface to which new metal must adhere. Remove all signs of rust, scale, grease or paint by sand- or grit-blasting to provide a bonding surface for the sprayed metal. Small pieces may be prepared in a lathe by turning to a rough surface. Protect the finished piece against handling because sprayed metal will not adhere to oily or oxidized surfaces. After preliminary machine work, we make it a practice to wrap all parts in clean paper before removing them to the lathe for spraying. Experience has proved that best results are obtained if spraying is started immediately after roughening and cleaning is completed.

We sprayed the first unit with copper which, to our surpise, did a good, serviceable job. We have experimented with several types of metal for reconditioning plug cocks and find a bronze alloy most satisfactory for our requirements. The coating varies in thickness up to ¼ in., when finished. This metal gives the plug a bronze-coated surface to slide against the iron surface of the body. Two dissimilar metals operating against each other prevent frictional seizure, galling and sticking. Of necessity, the valve must be close fitted, so each reconditioned plug is ground-in to the body after final machining.

Not only have we successfully built up the plugs, but also the inside of the bodies. Stainless steel was applied to the bodies. After cooling, our first experimental attempt showed evidence that the thin surface liner had shrunk from the cast-iron body. The valve was put in service, however, and after seven years it is still in operation. We now preheat the bodies to avoid this condition.

With the number of such valves ranging from 4 to 8 in. in a large plant like ours it is not difficult to understand why we have equipped our shop with a special metalizing lathe, fume-exhaust system, and the necessary spraying equip-

Fig. 1—Plug, removed from 8-in. cock after 22 months of continuous service, shows that the original metalizing thickness of ¼ in. has now been reduced to 3/32 in.

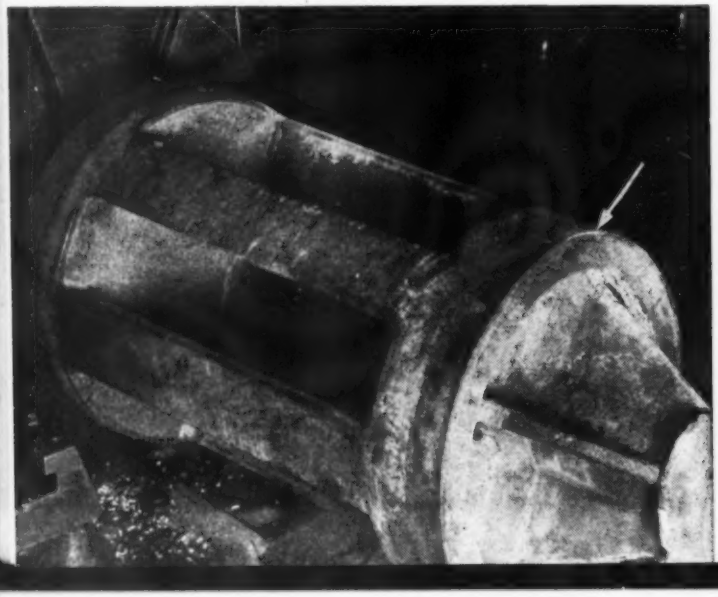


Fig. 2—Preparatory work for metal spraying includes a rough-cut machining operation. The previously sprayed coating does not peel when the lathe tool cuts into it

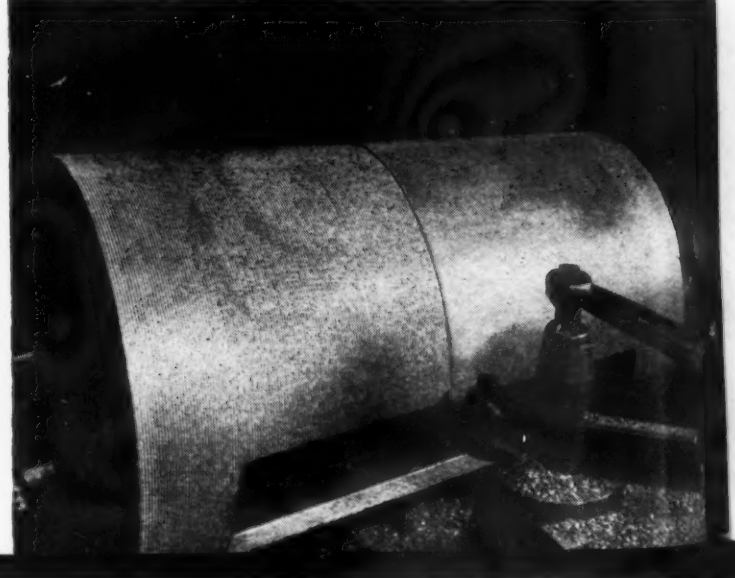


Fig. 3—The spraying operation is carried out in a special lathe, fitted with an exhaust ventilating system that draws off excess metal particles and gas fumes. An adjustable bracket positions the gun near the work

ment to do this reconditioning work.

Spraying Operation. The spray gun consists of a small, lightweight power unit handling either 11-gage or ⅛-in. wire, which, together with the necessary regulating valves connected to the oxygen, acetylene and air supply, comprises the metalizing plant.

In setting up the equipment for spraying we locate the gun 5 to 8 in. from the work. Pointing it directly at the surface produces the most satisfactory results. Sometimes, when this is not possible, the operator must work from a position of less than a right angle to the work. Never have the gun angle less than 45 deg to the surface.

Before beginning actual spraying, give careful attention to the flame-setting. The flame should always be neutral. Too much oxygen causes oxidization of the molten metal, and carburizing results from too much acetylene. Excess in either direction reduces the quality of the work.

Structure of the deposited metal is granular rather than homogeneous. This is the result of the high velocity at which the minute semimolten particles are deposited on the parent surfaces, there to be flattened out as they build up on one another. End result produces a granular metallic coating whose compressive value is slightly higher, tensile strength lower, and structure less dense than the metal itself. Brinell hardness of many of the metals is increased about 35%. Fatigue tests prove sprayed metals unsatisfactory where they have to withstand repeated reversal of strain or stress. The result in a mechanical bond should be obvious.

A much stronger bond is obtained when the sprayed metal is applied to the outside of cylindrical surfaces rather than to flat areas. On an outside cylindrical surface the metal builds up as a sleevelike coating, which contracts on cooling and shrinks to bond tightly to the object. On concave surfaces the base metal should be preheated and a higher temperature maintained throughout spraying so that on cooling, the object will shrink in about the same ratio as the liner.

Machining Operation. The machining of sprayed coatings can, in general, be performed quite satisfactorily. Exceptions, however, are high carbon steel or other metals that produce a hard face. Some of the bronzes present no difficulties; they machine well and take a good finish. It has often been pointed out that a sprayed-metal coating is something like an iron casting and the finishing characteristics are much the same. With this thought in mind, the inexperienced or unintiated machinist will do well to follow the instructions given by manufacturers of spraying equipment. The tool bit cannot be ground or set as for solid metals because it results in small crumbly chips and produces a porous surface.

The operator must experiment to find the proper tool setting and clearance of the cutter to overcome these conditions. Generally, results are better if the tool is set a little above center to reduce the front clearance to a minimum. This rule is particularly true in making the finished cut.

For final finish, best results are obtained if machining is brought to within 0.010 to 0.012 in. of finished dimensions and remaining metal removed with a fine-cut mill file. For surface finishing and polishing, increase the peripheral speed of the work and use emery or crocus cloth.

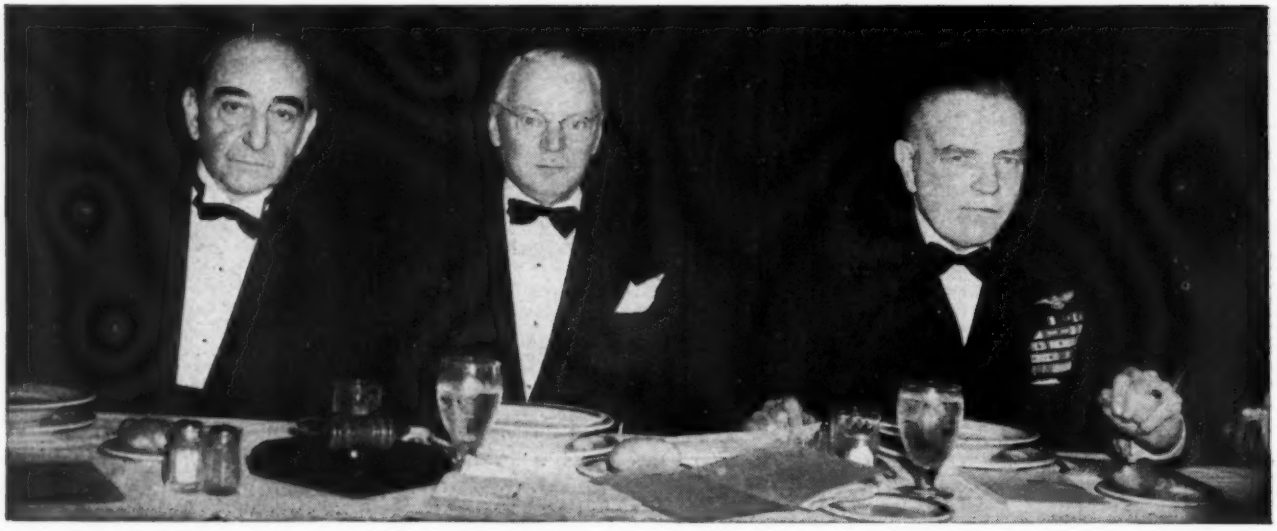
Surface Grinding. The grinding of sprayed metals has received considerable attention and study. Here again, the operator has to depart from so-called standard procedures. He may find the grade and grain of the wheel he has been using entirely unsatisfactory. It may load up and produce a discolored surface. Grinders and wheels are now available that do highly satisfactory work of this type.

Provided the proper wheels are used, wet grinding produces a better and more satisfactory job than dry grinding. The work should, however, be performed in accordance with the manufacturer's recommendations for proper speed and feed.

It is essential to remember that success depends upon following a few simple rules—a clean roughened base, proper gas adjustment, and careful machining. While no special skill is needed, producing a satisfactory job does require study and care. The machinist must remember that in the finishing operation he is working with an unfused metal veneer instead of solid metal.

Considering the high cost of some apparatus we find it more economical to overhaul the parts than to restore equipment with expensive items.

New Power Trends Revealed At Tenth Midwest Conference



James D Cunningham (center), president of Republic Flow Meters, presided at the "All Engineers" dinner where Admiral William F Halsey (at the right) told how the last war was won, and R H Deupree, president of the Procter and Gamble Co and chairman of the Army and Navy Munitions Board, revealed the job for industry in the next war

Papers size up gas turbines, heat pumps, radiant heating and electronics, with many new slants on fuels, central and industrial power, diesels, hydro power, smoke, safety and feedwater

▶ YEAR AFTER YEAR, since the Conference reorganization in 1938, the Illinois Institute of Technology and other cooperating educational institutions of the Midwest have sponsored a well-rounded, practical and broad-gage Midwest Power Conference at Chicago's Palmer House. With strong emphasis on trends and new developments, this year's Conference, March 31 through April 2, was outstanding in breadth and practicality.

Twenty-five hundred engineers heard a total of 39 papers. Subjects included electric-power supply, gas turbines, diesel power, combustion control, plant safety, panel heating, "heat pumps," air conditioning, industrial electrical distribution, hydro power, fuels, pulverized coal, future energy sources, paper-mill power, air pollution from small boiler plants, electronic controls, metals for piping and pumps, feedwater treatment.

Along with a solid menu of technical power papers, the Conference gave adequate attention to the broader responsibilities of the engineer as an American and a world citizen.

Evaluating economic trends at the opening session, Pearce Davis, director, dept of business and economics, Illinois Institute, held out some hope that man may eventually smooth the bumpy boom-bust curve of the traditional business cycle. In a generally favorable present-business picture he cited the continued rise of prices as a disturbing and dangerous factor.

Engineer Citizens. George P Torrence, president of Link-Belt Co, and Monday luncheon speaker, asked engineers to respect the efforts of workers in the nonexact sciences—sociology, economics, political science and psychology—to solve some of mankind's most difficult and urgent problems.

Allis-Chalmers, recent storm center of a labor controversy lasting many months, quite fittingly sent its vice-president, W. C. Johnson, to present a business man's slant on labor. The activities of certain labor leaders, said Johnson, threaten the very life of America.

James D Cunningham, president of Republic Flow Meters, presided at the annual "All Engineers" dinner. Featured speakers were Admiral William F Halsey and Richard Deupree, executive chairman, Army and Navy Munitions Board and president of Procter and Gamble. Halsey warned of the dangers of one-sided disarmament. Deupree outlined the program for industrial preparedness.

Speakers at a session devoted to the engineer's contribution to civic progress were Edward J Kelly, just retiring as Chicago mayor, R M Gates, president of Air Preheater Corp, and Joseph D Lohman, lecturer in sociology at Chicago University.

Gates urged engineers to take a more active part in public affairs. The engineer's realistic and objective approach is much needed, he said, particularly in attacking such problems as management-employe relations, economical operation of government services, the balancing of social control and free

enterprise, conserving natural resources, industrializing backward countries and controlling atomic energy.

Electric-Power Supply. Col H S Bennion, managing director, Edison Electric Institute, surveyed present-day trends in electric-power supply. While the demand growth rate continues at an astonishing rate, the future potentialities for service appear to be enormous, he said. He estimated that the total peak load will grow by 3,000,000 kw annually in both 1947 and 1948.

Many factories changing from continuous to single-shift operation explains a national load factor, falling from 64.2% in Dec. 1944 to 58.7% in Dec 1946. Present orders for new generating equipment exceed 13,000,000 kw, and from 15 to 19 million kw will be installed in the next five or six years. About 25% of the turbines and generators on order follow the ASME-AIEE standards, said Bennion.

Newer stations require one third less operating force than older stations of the same capacity. Semi-outdoor installations are increasingly popular in all parts of the country.

During 1946, plant construction costs were 30 to 100% above prewar prices, averaging 50% up. Despite this the speaker expected a continued decline in the selling price of electricity, assuming no further inflation of the dollar.

In "Electric Power—Its Relation to National Defense," John W Swaren, research analyst, Industrial College of the Armed Forces, noted that three times within the life span of men now living the U.S.A. developed a defense mechanism that disintegrated after a war. But we do have an important nucleus of a new defense structure, the electric-power industry, indispensable in war.

G L Jorgensen of Commonwealth Edison, in "Statistics of the Electric Light and Power Industry," showed the difficulty of anticipating future events by citing the fluctuations in reserve capacity available in the past, for example:

	Thousands kw		
Year	*Peak*	*Capacity*	*% Reserve*
1920	9,600	14,400	50
1929	20,100	31,600	57
1934	20,000	35,800	79
1945	40,500	50,100	24
1946	45,500	50,300	11

Schooled by an eleven months' strike, W C Johnson, vice-president of Allis-Chalmers Co, spoke on the subject, "A Business Man Looks at Labor"

The U.S.A. has about 6% of the world's population, he noted, but produces 43% of the total electric energy.

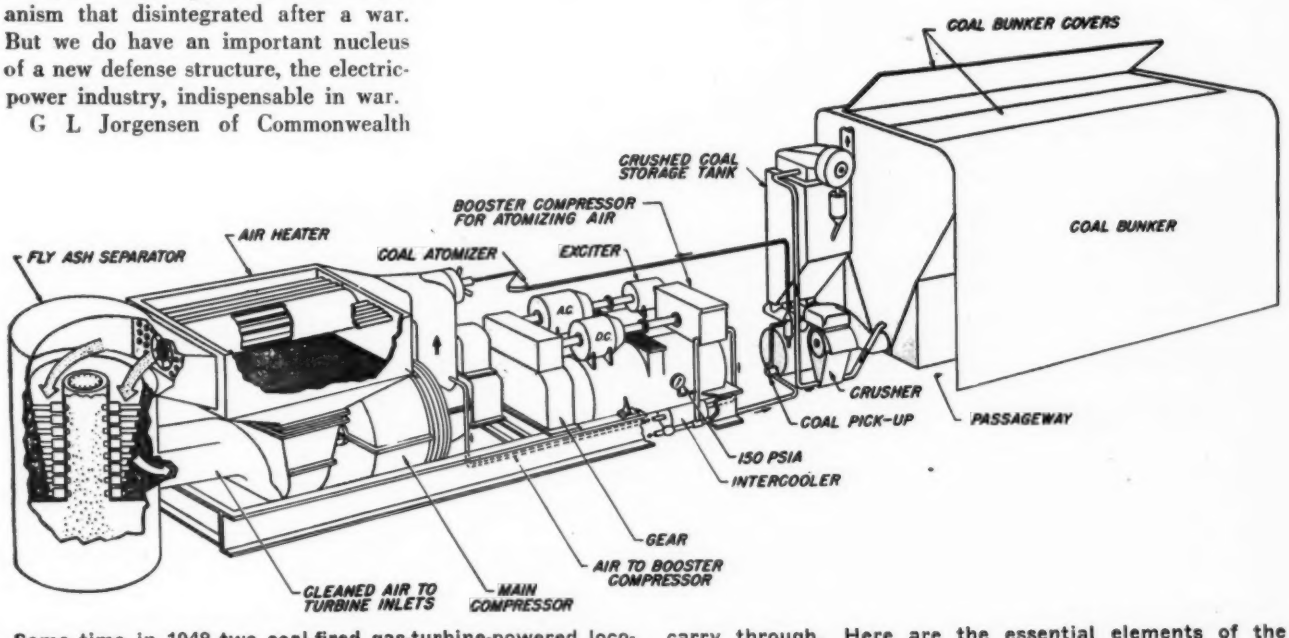
Future Fuels. The changing fuel patterns expected to characterize future power operations lent special interest to the paper, "Energy Sources of Tomorrow," by Ralph A Sherman, Battelle Memorial Institute. Noting the constant growth in use of oil and gas in the face of known reserves that are very small in comparison to coal, he examined the possibilities of synthesizing these fuels from coal. Sherman predicted ultimate low-cost conversion of coal to produce needed amounts of oil and gasoline.

Hydro Power. "Correlation of Hydro and Steam Plant Operation," by Vincent Thieman, Wisconsin Public Service Corp, described the general layout of this power system. He pointed out that WPSC pioneered hydro-station automatic control almost 25 years ago in three plants, controlled by a fourth.

Outage time of hydraulic units on this system is about 1% compared to 11% for steam boilers and 5% for steam turbine-generators.

In "Keokuk Hydro—A Third of a Century Old," P L Mercer of Union Electric Power Co, told the life story of this 130,000-kw plant on the Mississippi River. After 34 years Keokuk still operates at its original efficiency. Rewinding the 25-cycle generators for 60-cycle operation has been the only major modification of the station.

The present power facilities and future plans for the Missouri River



Some time in 1948 two coal-fired gas-turbine-powered locomotives will actually be on the rails if the present plans of John Yellott's Locomotive Development Committee carry through. Here are the essential elements of the power unit designed to meet the growing challenge of the diesel locomotive to both coal mining and coal haulage

Basin were reviewed by E Robert de Luccia, Federal Power Commission. At the end of 1945 this area used 3316 million kwhr with a peak demand of 745,000 kw. Surveys indicate 8200 million kwhr use by 1960 with a peak demand of 1,700,000 kw. About 1,160,000 kw in hydro and 1,645,000 kw, plus reserve in fuel-electric capacity are anticipated for the year 1970.

Diesel Trends. Incomplete studies indicate that the use of certain low-cost metals in the combustion chambers of internal combustion engines may radically improve operation. C G A Rosen, Caterpillar Tractor Co, said that this would narrow the differences between spark-ignition and compression-ignition engines. He predicted the development of a truly economical high-output internal-combustion engine using economical fuels widely available.

Gas Turbines. The gas-turbine session under the chairmanship of John T Rettaliata, Illinois Institute of Technology, featured three papers: "Where Will the Gas Turbine Fit as a Stationary Power Plant?" by L N Rowley and B G A Skrotzki, of POWER; "Recent Gas Turbine Developments at Brown Boveri," by P R Sidler, Brown Boveri Corp; "The Coal-Burning Gas-Turbine Power Plant," by J I Yellott, Locomotive Development Committee.

Rowley and Skrotzki set up some hypothetical economic demonstrations showing where gas-turbine plants offer means of producing cheaper power for isolated-plant and central-station service. Under certain given conditions a regenerative-cycle gas turbine proves more economical than a high-pressure high-temperature steam plant. A simple-cycle gas turbine may prove economical as a peak-load plant only when applied to a system with a high-efficiency performance. Also, simple-cycle gas-turbines as boosters and peak-load units at the end of transmission lines can pay out handsomely, the authors stated.

They described applications of combination gas-turbine cycles to produce process steam as well as power. These range from waste-heat boilers for low-pressure steam to modified Velox-boiler application for high-pressure steam. Several arrangements were suggested for using steam and gas turbines in tandem.

Reviewing the gas-turbine activities of Brown Boveri, Sidler said that these units are now sold commercially with guarantees similar to those given for steam turbines. However, special production facilities and standardized sizes have not yet been provided, so early deliveries are not possible. Shop tests of units recently completed for stationary service have shown actual performance to be better than guaranteed, he said.

A feature of Sidler's talk was the new "Comprex" unit, described as a "pressure exchanger." It acts as the final-stage air compressor in a gas-turbine cycle, using 1800-F gas from the combustion chamber to perform this work. Besides raising the cycle thermal efficiency from 18 to 22.5%, it has the added advantage of extreme compactness. The Comprex pressure ratio is 3:1.

Yellott's paper was a progress report on the many investigations being carried on by his Locomotive Development Committee in designing a coal-burning gas-turbine locomotive. This group expects to have two locomotives on the rails in 1948. Work is now under way on full-scale prototypes of some equipment elements.

Power Safety. Seven tenths of the money loss in power-plant accidents covered by insurance has been caused by the carelessness, ignorance, indifference and short-sightedness of owners and operators. To back this statement W D Halsey, chief engineer of Hartford Steam Boiler Inspection and Insurance Co, cited case histories. Management, he declared, must take the lead in safety promotion and make certain that operators realize the dangers hidden in power production.

Control Methods. Reviewing central-station combustion-control methods, C H Smoot, of Republic Flow Meters, said that accuracy, stability, speedy response and coordination at steady and changing loads must be obtained with a system that is simple, reliable, inexpensive and adaptable to a wide range of conditions. Any system should maintain (1) constant steam pressure (2) constant furnace pressure (3) constant fuel-air ratio.

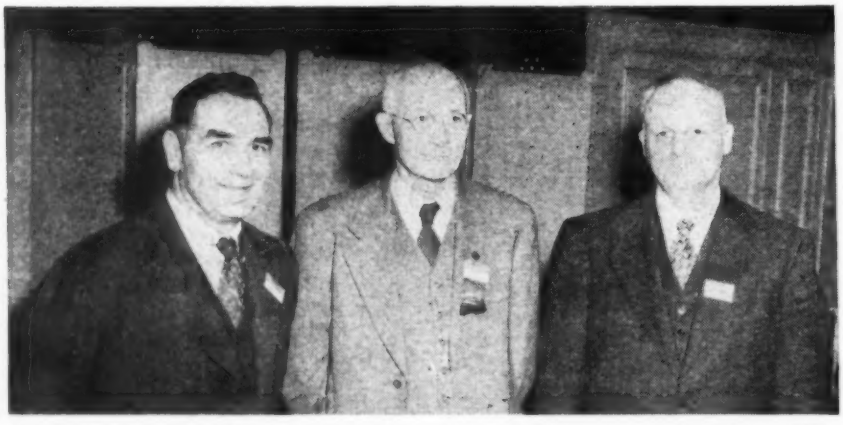
C H Barnard of Bailey Meter Co, in his paper, "Electronics in Power and Process Instrumentation and Control," reviewed the principles of utilizing electronic devices. Their judicious application has yielded such outstanding improvements as (1) lower maintenance cost through standardization (2) elimination of delicate coil suspensions (3) continuous instrument balance (4) increased range of measuring applications (5) quicker instrument response (6) fewer components, even for complex metering.

Pulverized Coal. Otto de Lorenzi, of Combustion Engineering Co, compared various methods of firing pulverized coal: vertical, horizontal-turbulent and tangential. He discussed the characteristics of each in terms of the variables that influence selection: size, shape and volume of furnace, type of furnace-wall construction, amount and nature of coal to be burned, and character of load.

Industrial Power. In a session on industrial power, Robert Krause, Container Corp of America, outlined the power-service requirements of typical paper mills and indicated the nature of the plants built for such service. He presented estimates of the electricity, steam, water and air needs of typical mills per unit of product.

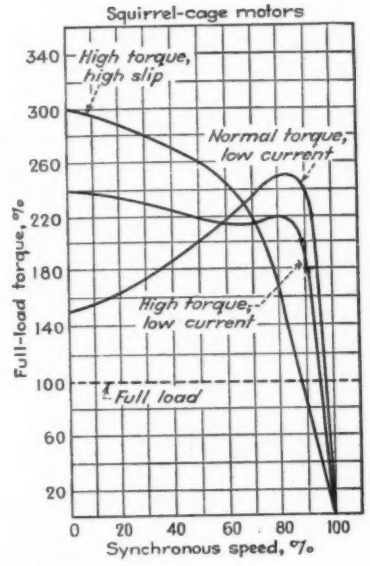
Tackling the currently important problem of reducing air pollution from small boiler plants, Parker A Moe, of Gates, Moe and Weiss, consulting engineers, stressed the need to educate all

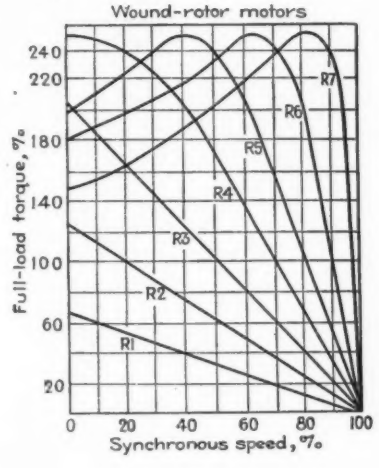
(*Continued on page* 154)

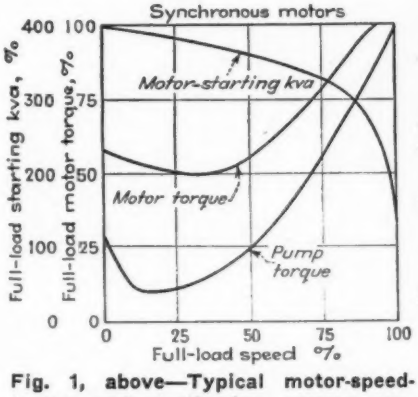


Small-plant engineering trio. Professor M P Cleghorn (center) of Iowa State College, presided at session, while Robert Krause (at left) Container Corp of America, outlined the power requirements of typical paper mills. Parker Moe, Chicago consulting engineer, told what to do about industrial smoke and dust

How to Apply AC Motors Economically







Misfit motors can exact tribute in the form of lost production and profits. Carl Bauman, chief electrical engineer of American Cyanamid Co, says it is axiomatic to expect efficient, economical operation if the motor is correctly applied

► SELECTING THE CORRECT DRIVER is a real problem that confronts the plant engineer. Not only must he pick the lowest-cost motor that fits mechanical, physical and electrical characteristics demanded by the load, but he also has to keep in mind maximum long-term economy.

One way to simplify his task is to analyze the driven machine and tabulate these pertinent facts: (1) horsepower required (2) torque range (3) operating cycle—frequency of starting (4) speed considerations (5) coupling method (6) operating position—horizontal, vertical or tilted (7) direction of rotation (8) type of bearings (9) end play, balance, thrust (10) ambient temperature (11) surrounding conditions (water, gas, corrosion, dust, outdoor) (12) altitude.

In addition to data on the drive, it is important to know these facts about the electric power system: (1) voltage at which motor operates (2) number of phases (3) frequency (4) power company limitations on starting current (5) effect on power rates for demand and energy.

Horsepower Rating. Economically, the most important consideration is horsepower rating. A motor loaded to full capacity operates at maximum power factor and, therefore, more efficiently. This results in an over-all saving in monthly power costs and demand charges. Motor size and horsepower requirements of the machine should be carefully matched. Where possible, get motor performance data and load requirements of the machine from the manufacturer. If performance data are not available they can be obtained from a prony-brake load test. Standard handbooks show construction details, and horsepower is found as follows:

$$\text{Brake horsepower} = \frac{2 \times N \times T}{33{,}000}$$

where:
N = revolutions per minute
T = motor torque or force on scales times length of lever arm lb-ft.

Photos, courtesy of Chemical Construction Corp

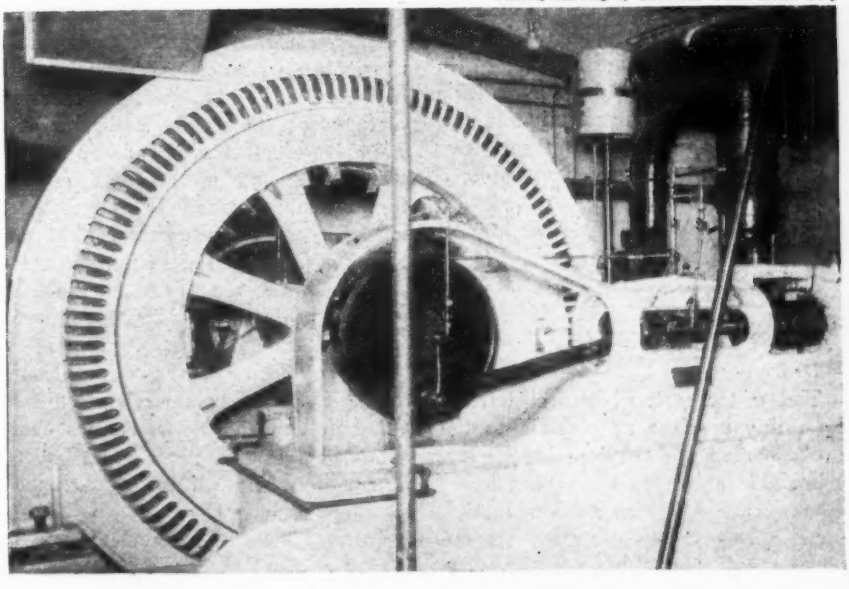


Fig. 1, above—Typical motor-speed-torque and starting-kva curves, supplied by manufacturers, which aid in selection of correct motor. Fig. 2, right—Large synchronous motor driving a compressor in a chemical plant

Horsepower requirements of the load can be obtained by calculation from the constants of the driven machine, but this requires special skill and often tedious calculations that do not always yield accurate results.

A more practical method is to measure shaft-horsepower input to the machine, which has been calibrated with the original motor, or with a test motor whose efficiency and power-factor curves are available. Run the machine at or near rated load and meter the motor volts and current input. From these data find required hp by substituting in the following equation:

$$Hp = 0.00232\ E \times I \times Eff \times PF$$

where:
E = motor line volts
I = phase current, amperes
Eff = motor efficiency from manufacturer's curves
PF = motor power factor from manufacturer's curves

Typical speed-torque and kva curves, as in Fig. 1, also efficiency and power-factor curves, are published in most manufacturers' catalogs. These curves are accurate enough to estimate power requirements for motor selection.

VARIABLE CYCLE

With production machines that operate continuously at rated hp, no other information is needed to specify the required driving motor. If the load varies in accordance with some regular cycle, the full-load hp rating will be the *root-mean-square* (*rms*) *hp*. Specifying a motor size equal to the maximum hp in the cycle overpowers the application and, consequently, lowers the efficiency and power factor.

The rms hp is the equivalent continuous hp that would produce the same heat in the motor as the cycle operation. To find this hp, square the hp for each phase of the cycle and multiply it by the time of the phase in minutes. Add these values, and divide by the total time of the cycle in minutes. Extract the square root of the results, which gives rms hp. For example, a load requires 50 hp for 10 min, 20 hp for 5 min, 14 hp for 17 min, and 30 hp for 7 min.

$$\text{Rms hp} = \sqrt{\frac{(50^2 \times 10) + (2^2 \times 5) + (14^2 \times 17) + (30^2 \times 7)}{10 + 5 + 17 + 7}}$$

$$= 30.6 \text{ hp}$$

The motor selected should have a hp rating as close as possible to the brake horsepower required by the machine. For example, if a load requires 49 rms hp, fit it with a 50-hp motor; for a 52-rms-hp load use a 50-hp open-type motor if surrounding conditions are favorable for its use. In the above example, a 30-hp motor does the job.

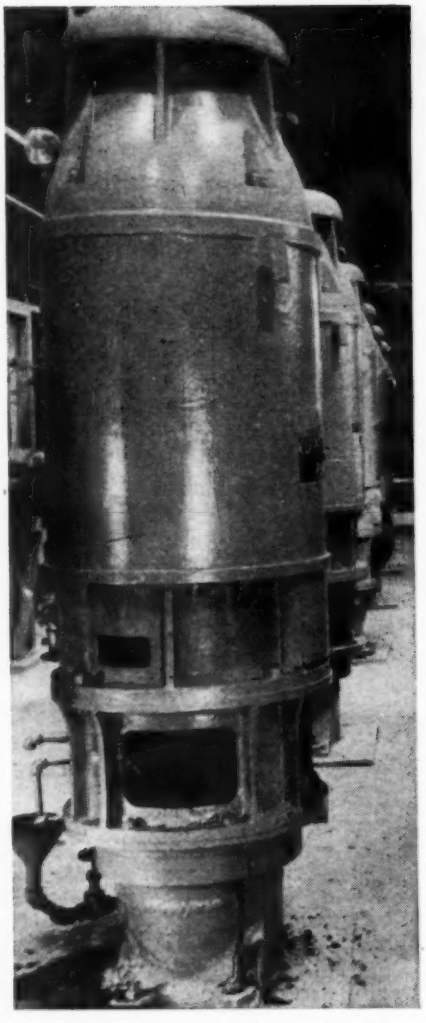


Fig. 3—Battery of high-speed vertical motors used to drive high-head pumps

Torque Requirements. Next job is to determine torque requirements. Too often this characteristic is completely overlooked with costly results in time and money. For instance, engineers in a Canadian plant found that a new 700-hp induction-motor pump drive would not come up to speed on the highest reduced-voltage starting tap permitted by the power company. This restriction was imposed to limit kva inrush, so the motor had to be replaced with one having a lower starting current for the same torque. Again, in a chemical plant on our Eastern seaboard a centrifuge would not accelerate to full speed in time to prevent serious overheating of the driving motor. It had to be replaced with one having a higher starting torque.

Torque is the turning moment a motor is capable of producing. To be adequate for the drive, a motor must be able to produce enough torque to overcome the machine's inertia, plus the additional amount needed to accelerate it to full speed—all this in time to prevent the motor overheating during the starting period. Surest way to determine whether the motor can produce adequate torque from standstill to full-load speed is to plot speed-torque curves for the machine and motor to the same scale. A typical curve for a centrifugal pump is shown in Fig. 5.

If at all speeds for a given starting voltage the motor-torque curve lies above that of the machine, there will be no difficulty in bringing it up to speed. Time required to do this depends on torque available for acceleration: the amount represented by the vertical distance between the machine and motor-torque curves for any given speed. If motor-torque curve crosses below machine-torque curve, the motor will hang at the speed corresponding to the crossing point and cannot accelerate beyond this value.

Inertia of the machine's moving parts is the product of the mass of these parts by their aggregate radii of gyration squared. Usually the manufacturer can furnish this value. Approximate time for acceleration from standstill to full speed can be calculated by the equation:

$$\text{Time (sec)} = \frac{RPM \times WR^2}{T \times 308}$$

where:
RPM = full-load speed
WR^2 = inertia of moving parts in lb-ft squared
T = average torque available for acceleration in lb-ft

Remember that the torque produced varies as square of the voltage applied to the motor terminals. Since published motor-torque curves are represented at full voltage, a corrected curve must be made if reduced voltage starting is required. Thus, if the motor is to start on 0.8 normal rated voltage, a new torque curve is plotted for each speed at

Table I—Starting Torque

Comparisons for Typical Machines

Low- and standard-torque equipment up to 125% full-load torque:	
Centrifugal pumps	Blowers
Fans	Compressors
Reciprocating pumps	
High-torque equipment over 125% full-load torque:	
Ball mills	Centrifuges
Crushers	Punch presses
Rolling mills	Shears

0.8x0.8, or 64% full-voltage torque values. Dotted curve, Fig. 5, represents such a torque.

Since machine-speed-torque curves are not always available a motor having ample torque can be selected for the drive without using such curves if care and judgment are exercised. Considering that the torque required from a motor varies as product of the speed and inertia of the driven parts, Table I has been prepared to show relative starting torques for typical driven machines. If machine speed and general torque range are known, a motor having enough torque can be selected from standard types.

Ac Motors Used. The most frequently used ac motors are: (1) Squirrel-cage induction motor (for full-voltage starting) for normal-starting torque, low-starting current; high-starting torque, low-starting current; high torque, high slip; normal-starting torque, normal-starting current (not recommended unless reduced voltage starting is used). (2) Wound-rotor induction motor—variable torque by external resistors. (3) Synchronous motor—low-starting torques are standard. High starting torques may be had on request. Fig. 1 shows torque ranges for typical motors.

For most applications, squirrel-cage induction motors meet torque requirements of the driven machine. They provide the simplest drive and by far the most economical. Wound-rotor motors are recommended for frequent starting and stopping of a high-torque load.

Before the correct motor can be selected the operating cycle of the driven machine must be studied. If it operates for at least 15 min at constant load during the cycle, the horsepower can be taken as amount required to carry this load without exceeding the motor's

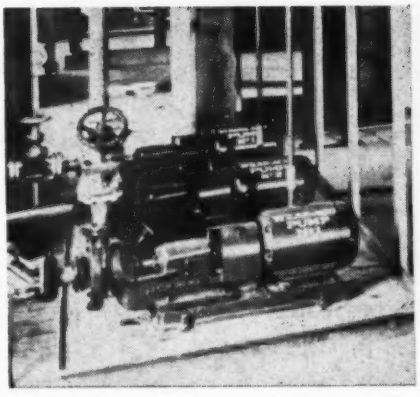


Fig. 4—Small motors as well as large should be selected to suit each job

rated (continuous) temperature rise. For a machine having a cycle occurring one or more times in 15 min, determine the hp by the rms method previously described. This method does not apply if the motor must be started once each cycle because the locked-rotor current normally accounts for 25 to 36 times the heating obtained on full-load operation when starting on full-line voltage. If such severe duty is required get the motor manufacturer's recommendation before selecting a motor of standard rating.

The manufacturer's advice is equally important on motor drive for high-inertia applications. If such machines must be started often it may be necessary to use a larger frame-size motor to keep the heating within rated limits for a long starting time. For example, a machine requiring one minute to accelerate its motor develops about as much heat as it would carrying full load about a half hour. Loading of electrical equipment is limited only by maximum permissible temperature rise, provided it carries the load mechanically. Therefore, if a motor's temperature rating is exceeded without delivering full-nameplate hp, a motor of higher hp rating must be selected to keep from damaging it.

Motor speed is the next characteristic to consider. For constant-speed applications, speed is selected from the manufacturer's published data. In normal induction motors full-load speed is about 2 to 4% less than synchronous speed; this percentage represents the slip. Synchronous motors always run at synchronous speed when field is applied, hence their name. Some high-slip motors lose as much as 13% of synchronous speed at full load. Wound-rotor induction-motor speeds can vary over a wide range with resistors in the secondary circuit. Table II gives speed ranges of ac motors available.

Fig. 5—Machine and motor torque curves, plotted to same scale, show ability of motor to accelerate machine to full-load speed

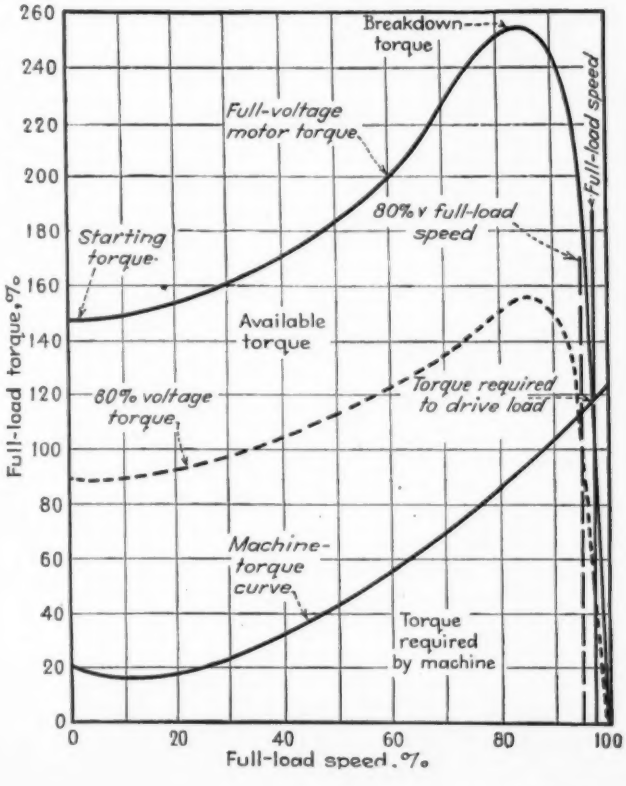


Table II—Speed Ranges of Ac Motors

Type of motor	*Speed range*
SINGLE PHASE:	
* Brush-shifting repulsion induction	2 ½:1
* Capacitor motor with tapped winding	2:1
Multiwinding capacitor motor	2 or 3 fixed speeds
POLYPHASE:	
Squirrel-cage motor	1 fixed speed
Multiwinding squirrel cage	2, 3, or 4 fixed speeds
* Wound-rotor motor	2:1
* 2-winding wound-rotor motor	4:1
Brush-shifting shunt motor	4:1
* Brush-shifting series motor	3:1
* Squirrel-cage motors, variable-frequency supply	4:1

* These motors have wide speed regulation.

Why Foresight in Coal-Bunker Design Pays Off in Trouble-Free Operation

Capacity and cost aren't the only considerations determining selection of coal-bunker type, says Eugene Hahn. For operating satisfaction, give thought to discharge efficiency and construction details that help to reduce cost of maintenance

► ALL TOO FREQUENTLY, the power-plant designer pays little attention to the bunkers for coal storage beyond assuring himself that the theoretical capacity is provided and that structural strength requirements are met. What appears simple on the drawing board, however, may be the source of considerable grief to the operator. He becomes acutely aware that discharge efficiency is the important criterion—how much of the stored coal is actually available without annoying and, occasionally, hazardous trimming and manipulation? Even if satisfactory operation can be obtained with a bunker that has a discharge efficiency of, say 75%, the "dead" coal cannot be ignored; it may serve as the starting point for heating and spontaneous combustion of stored coal.

Must in Design. Thus, for satisfactory operation, a primary consideration in bunker design is high discharge efficiency. Freedom from excessive maintenance is likewise important to the operator. These two requirements must be met as far as possible with a design that is relatively simple and with material that is economical.

The conventional suspended-steel bunker, Fig. 1, with its plate sides forming a catenary-shaped trough, rates high enough from the standpoint of simplicity of design but its discharge-efficiency proves low because of the dead spaces between the outlets, from which coal cannot normally be discharged except by special effort.

To eliminate the dead spaces between outlets, a more complicated and expensive design has a bottom consisting of adjoining 4-sided pyramids, Fig. 2. Such a design normally solves the dead-coal problem, but is liable to bring with it a new source of difficulty—arching of coal between the sides of the pyramids, particularly at the reduced span right above the outlet. This arching may be eliminated or minimized in a variety of ways.

Eliminate Arching. Even crushed coal contains small lumps and fines, and under the pressure of the weight of the top coal in a tall bunker, the coal compacts sufficiently to form an arch. Eliminating sharp or acute corners in the individual hoppers tends to prevent lumps from wedging in the corners, and lessens chances for arching. In the final analysis, however, dependence must be placed on some form of mechanical agitation to break up the compacted mass that may occur in the best designed bunker.

Manual pounding of the sides of the pyramids, while often effective, is crude and time-wasting; the best solution usually lies in a substantially constructed agitator at each outlet. Without undue effort, the operator can use such an agitator periodically, and successfully disturb any arching formation for about three feet above the outlet. But in the average hopper, this section is the real bottleneck; beyond this point the increasing span of the arch weakens it and once the lower section has been disturbed by the agitator, arching at higher levels in the bunker can hardly be sustained.

Maintenance Cost. The question of mintenance cost centers largely around the choice of bunker materials. Steel plate. with due allowance for corrosion and abrasion, is widely used. To reduce the rate of deterioration, protective lining is frequently used. To be fully effective, it should be relatively flexible. For example, a concrete lining retained by wire netting successfully prevents abrasion, but deformation of the steel plate under varying load tends to produce cracks in the lining through which moisture can attack the metal, with resultant corrosion and deterioration behind the lining.

An alternative lies in constructing the

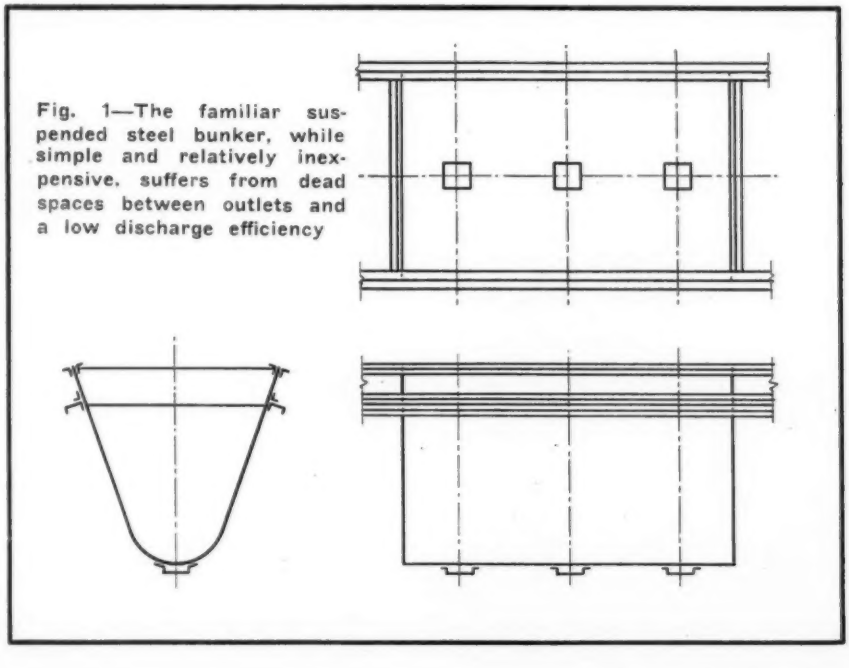


Fig. 1—The familiar suspended steel bunker, while simple and relatively inexpensive, suffers from dead spaces between outlets and a low discharge efficiency

bunker of a material that is rigid enough to resist bending and also possesses the ability to resist both corrosion and abrasion. Reinforced concrete ranks high on both these scores, but such construction, with properly designed hopper bottoms, is likely to be expensive and to require excessively heavy supports because of its relatively great weight. Unmachined cast iron is also known to resist corrosion and abrasion well, and has the further advantage of being but little heavier than steel-plate if properly used.

The design of a cast-iron sectional bunker is shown in Fig. 3. This unit consists of sections of plate, about 2x2 feet, with structural members on the outside. By judiciously placing the structural members with regard to the loading of the bunker, thickness and weight of the cast-iron sections can be held down to little more than that of steel plate. The dead load of a properly designed and constructed bunker of this type may run about 30% more than that of a suspended-steel bunker, but the increase in combined live and dead load runs only about 5 to 10% higher with the cast-iron unit, so that its supporting structure is only slightly heavier than that of a corresponding steel-plate bunker.

The Final Test. For an apparently simple component of the power plant, bunkers can be the source of substantial operating difficulties and, in extreme cases, of interruptions of service due to possible clogging of coal and spontaneous combustion. The power-plant designer can eliminate or reduce these problems to a minimum by exercising the same thoughtful care in designing bunkers that he applies to other, more "glamorous" pieces of equipment, and by bearing in mind always that the final test of a bunker design lies in its operation and maintenance.

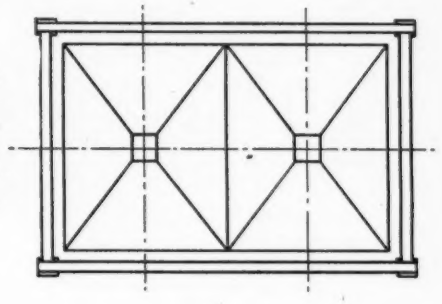
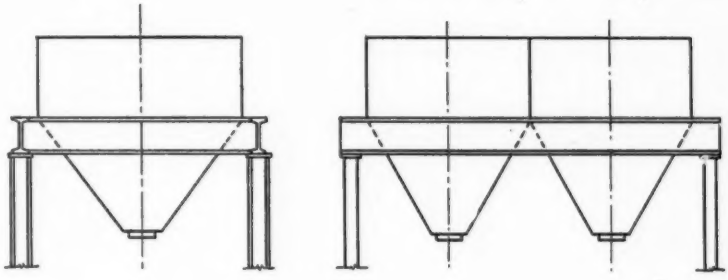


Fig. 2—Multiple hopper-bottom design avoids dead space but may cause arching, particularly right above outlets, where span is reduced. Agitation is the common solution



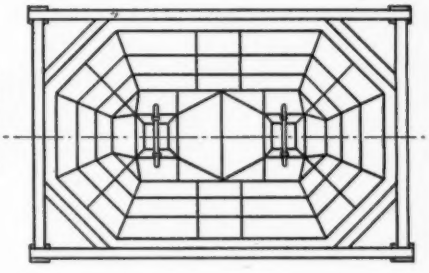
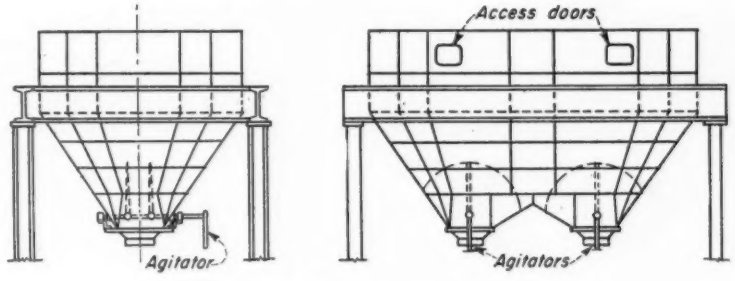


Fig. 3—Built of cast-iron sections to resist abrasion and corrosion, this oblong-octagon bunker weighs little more than a steel design for same capacity, has agitators



Labels Prevent Accidents

▶ UNLABELED CONTAINERS of solvents may lead to accidents as a result of ingestion or inhalation of the vapor. Moreover, the fire hazard of flammable solvents is not apparent unless clearly stated on the label.

To prevent misuse of their products, solvent manufacturers use warning labels, which indicate measures needed to assure safety. They were developed by the Manufacturing Chemists Association and are given in its *Manual L-2*.

Solvent drums or containers, if shipped direct from the manufacturer, are therefore usually labeled correctly. Frequently, however, the drum is kept in some centrally located spot, from which cans or bottles are filled. If these smaller containers are not properly labeled, the user is left ignorant of the nature of the liquid he is handling, and injury to health or a fire may result.

Every container should carry a label duplicating the information on the original drum. When refilling, compare the labels to prevent getting the wrong material. Supervision at the point of distribution is advisable, to make certain that these rules are carried out.—*Safety Research Institute*

Ten Ways to Make Tanks Safe For Workmen

Fig 1—Facepiece of a fresh-air mask can be supplied with air from a hand-operated blower or a length of hose (not over 25 ft) leading to the fresh air outside. *Courtesy, Mine Safety Appliance Co*

Liquid and gas containers can cause serious accidents if they are not thoroughly purged before work is started. To workmen, the lack of oxygen can be as dangerous as the presence of toxic gas. Play safe by adopting these precautionary measures

BY W E ROSSNAGEL, *Safety Engineer, Consolidated Edison Co. of N. Y. Inc.*

▶ INSPECTION AND MAINTENANCE require workmen to enter tanks and other vessels that have contained flammable or toxic materials, such as gasoline, illuminating gas, solvents, hydrogen, acids, refrigerants, carbon dioxide and carbon monoxide. To insure against even a remote possibility of explosion or asphyxiation, remove every trace of the objectionable liquid, vapor or gas, before men enter a tank, or apply heat to it. In other words, purge the vessel thoroughly.

Keep Fire Away. Tolerate no open flames or other ignition sources in the vicinity when opening a tank. This rule, of course, precludes smoking; it may be in order to place special warning signs around the area. Disconnect all piping from the vessel and blank off open ends of the disconnected piping, or insert a slip blank in a flange joint. It is not safe to depend on a closed valve, for accidental opening will allow flammable vapors or gas to enter the working space.

Purging With Air. Where the contaminating contents are toxic, purging may usually be done with air, and plenty of it. But never use air when flammable gas or vapors have been in a vessel. This precaution is necessary because the original contents, having a deficiency of oxygen, cannot burn; but if air is used for purging, there is a point between the too-rich and too-lean atmosphere where the vapor-air mixture in the tank passes through the explosive range. So remember to use steam, carbon dioxide, nitrogen or other inert gas to purge a vessel containing flammable vapors or gas.

Steaming. In using steam for purging, follow the *Regulations of the National Fire Protection Association*, as in Table 1, but exercise great care not to build up a pressure in the vessel beyond a safe limit.

In steaming a tank, keep the manholes at the top closed and, if possible, place the steam hose through an open manhole near the bottom. Make sure that the pressure- and vacuum-relieving devices are in working order.

Heat the tank; then shut off the steam and allow it to condense and draw in fresh air. Repeat the operation several times if necessary. This steaming should raise the tank shell to about 170 F. When the tank is finally heated to the maximum degree, remove all manhole covers and allow air to circulate through the openings.

Using Inert Gas. On small vessels, purging may be done more conveniently with CO_2, or other inert gas. Liquefied CO_2 may be obtained in large cylinders, such as soda fountains use, or in 50-lb fire-extinguisher size. A volume of CO_2 equal to at least 50% that of the vessel to be purged should render the tank atmosphere-safe. Exception is hydrogen tanks, which require 80%. The large 50-lb fire-extinguisher cylinders contain about 430 cu ft of CO_2, while the 15-lb extinguisher contains about 130. If spare units are available they may be used, but never remove fire-extinguishers from service for this purpose.

If CO_2 is in the form of dry ice, allow one pound, by weight, for each eight cu ft of tank volume. Break dry ice into small chunks to expedite evaporation inside the vessel; give it plenty of time to vaporize completely. Do not handle it with bare hands as it has a temperature of −110 F. When using gas for purging equip the hose with a nonferrous or other nonsparking nozzle, and ground it to the vessel to avoid any possibility of a static spark being produced by gas flowing through the hose.

Know Gas Density. When purging a vessel, remember, if the contaminating gas or vapor is of lower density than the purging medium, to admit the latter at the bottom of the vessel and allow the former to vent itself at the top. In general, where the contaminating gas is of higher density reverse the setup. Table II gives the relative density of various gases and vapors in which a power-plant operator may be interested.

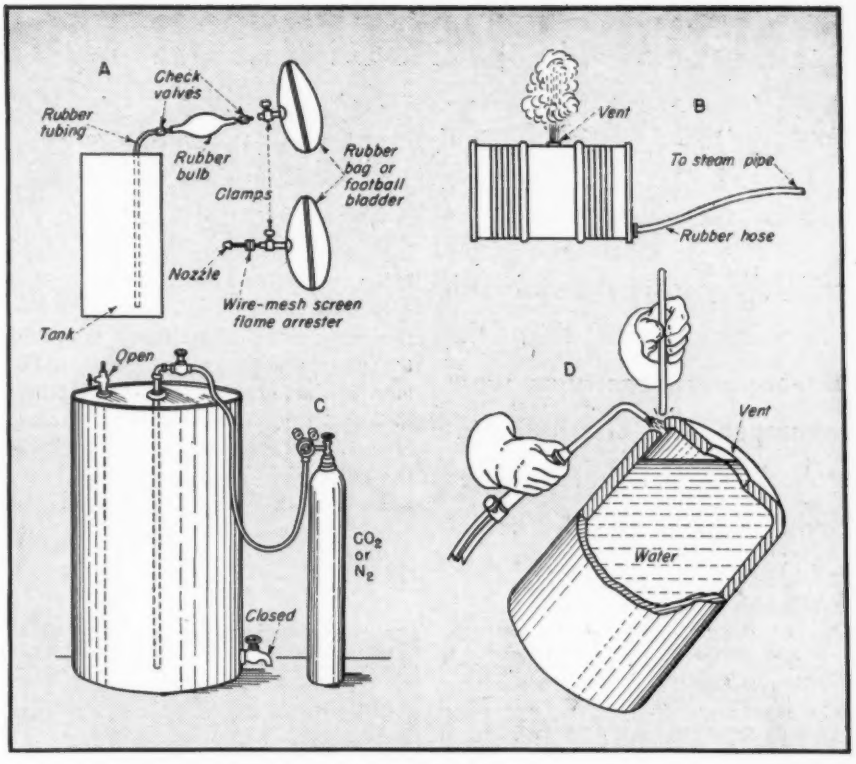


Fig. 2—Gas sampler consists of bladder, bulb, collecting tube and nozzle as shown in (A). Steaming a drum, (B). Introducing inert gas, (C). Using water to reduce gas space in a small tank, (D). *Courtesy, The Linde Air Products Co*

Table I—Steaming Time

Number of hours, 100 psi.

Vessel volume, cu ft	1-in. pipe	1¼-in. pipe	1½-in. pipe
30,000	20	14	10
40,000	26	18	13
50,000	32	22	16
60,000	38	26	19
70,000	44	30	22

From Regulations of the National Fire Protection Assn

Table II—Relative Density Of Gases and Vapors

Gas or vapor	lb per cu ft
Hydrogen	0.069
Illuminating gas	0.378 to 0.651
Steam	0.494
Ammonia	0.597
Acetylene	0.910
Nitrogen	0.967
Carbon monoxide	0.967
Air	1.000
Carbon dioxide	1.530
Propane	1.560
Alcohol	1.600
Acetone	2.000
Butane	2.050
Sulphur dioxide	2.260
Carbon disulphide	2.640
Benzol	2.770
Methyl bromide	3.270
Gasoline vapor	3.00 to 4.00
Kerosene vapor	4.500

Light gases, such as hydrogen, tend to pocket in upper parts of a vessel being purged and, if the vessel is indoors, under the ceiling or roof. On the other hand, heavy vapors like gasoline tend to pocket in the bottom of the tank and in nearby pits and trenches. Take precautions to prevent accumulation of explosive mixtures in such places.

Test the Atmosphere. After purging, blow the tank out with fresh air to remove the purge gas. Then make tests with a flammable-gas indicator to determine whether the tank is free of all flammable gas-air or vapor-air mixtures that might explode should a spark be produced accidentally. Collect the samples from various parts of the tank to insure against pockets.

In addition to the intial test, which occurs before any one is allowed to enter the vessel, take readings at frequent intervals to determine whether vapors are being given off by sludge or residue on walls or bottom of tank. Residue disturbed during cleaning operations may liberate additional vapors. If at any time the flammable-gas indicator shows more than 14 to 20% of the lower limit of the explosive range, stop work at once, get the men out of the tank, and resume purging without delay. If the job continues for more than one work day, take daily test readings before any one enters the tank.

Select Safe Tools. When necessary to remove sludge or scale from a tank that has contained a flammable vapor or gas, even though it has been purged, use nothing but beryllium-copper scrapers, hammers, chisels and shovels. Even a so-called nonsparking hammer may cause a spark if it strikes a glancing blow against a rusted surface formerly coated with aluminum paint. First job is to remove and dispose of sludge and other refuse preferably by burying them.

Air Circulation. Except during the time required to take readings on the flammable-gas indicator, fresh air should be circulated inside the tank. An air mover may prove useful for the

(*Continued on page* 146)

Electrical Deaeration Licks Corrosion in This Plant

Laboratory tests showed such promising results that the power-plant deaerators were revamped and electrodes installed so boiler feedwater could be treated electrically

By V RODWELL
Station Superintendent
Slough Estates Limited, England

► ELIMINATION OF THE CAUSE of severe corrosion in the high-pressure boiler feed lines and economizers was one of the most urgent problems facing the new senior engineering staff at the Slough Estates Limited power plant, Slough, Buckinghamshire, England, appointed during 1942 and 1943. Feedwater-treating system consists of the usual heaters, base-exchange softeners, deaerators and boiler feed pumps. Deaerator construction is shown in Fig. 2. A centrifugal pump, capable of delivering full deaerator rating (60,000 lb per hr) takes water from a feed tank or the base of the vessel, or both, through a 2-way valve, and delivers it to a spray valve at the top of the deaerator. Spray valve was hand operated and had to be wide open at all times to prevent the vessel being emptied when the deaerator operated at full load. This resulted in the pump always working at full capacity irrespective of the quantity of water required by the boilers.

Fig. 1—Float-lever arm uses a sliding connection to operate cone valve

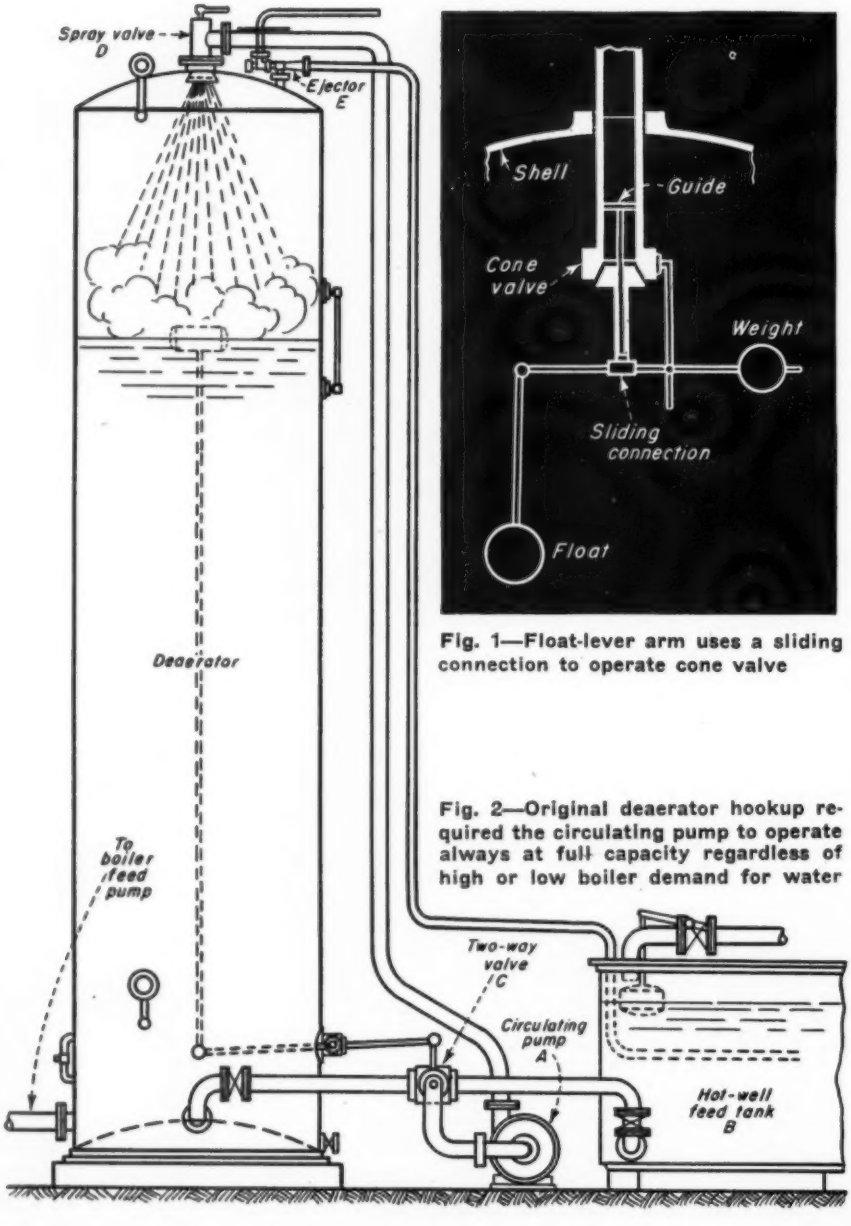


Fig. 2—Original deaerator hookup required the circulating pump to operate always at full capacity regardless of high or low boiler demand for water

A float-controlled 2-way valve operated the deaerator automatically. As demand on it decreased and water level rose the float moved the 2-way valve to throttle the feed-tank side and open the deaerator side so the pump recirculated water from the base of the deaerator to the spray valve. At no-load all water was recirculated and none taken from the feed tank. Conversely, at full load all water was drawn from the feed tank and none recirculated. A vacuum was maintained in the upper part of the vessel by an ejector, which removed the liberated gas, the degree of vacuum varying with temperature.

Basic Treatment. Boiler feedwater consists of returned condensate and makeup softened in a base-exchange unit. The softened water passes through a continuous-blowdown heat exchanger before entering the feed tank where mixing takes place. Alkalinity of the softened water is neutralized with sulphuric acid, which converts the sodium bicarbonate content to sodium sulphate and carbon dioxide. From the feed tank the mixed condensate and makeup passes through the deaerator before going to the boiler feed pumps.

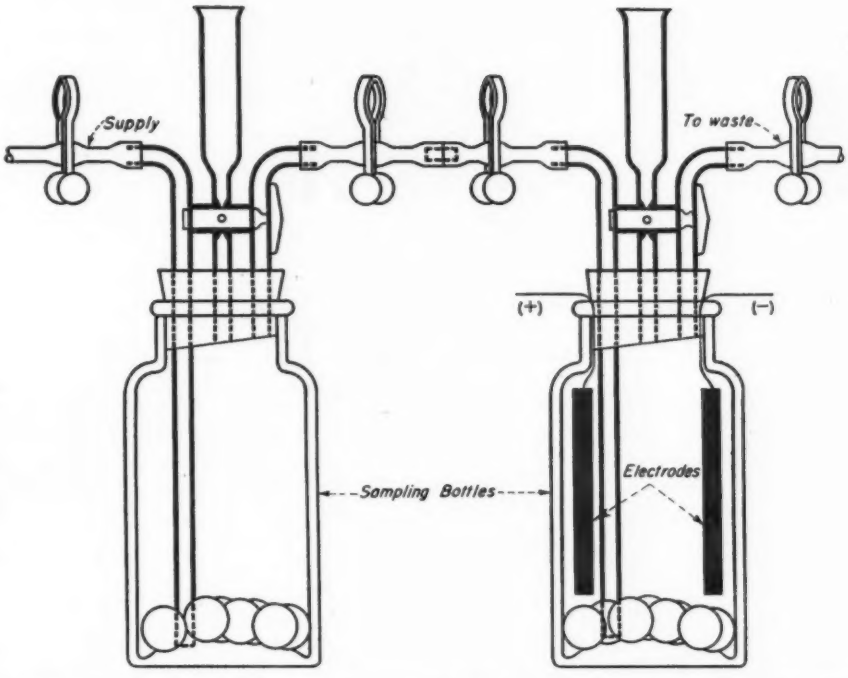


Fig. 3—Sampling bottles were arranged with electrode unit downstream when collecting water to eliminate possibility of its containing the best sample

Guaranteed oxygen-removal performance of the deaerators was only 0.06 ml per liter, which was rarely attained—values above 0.10 ml per liter being more usual.

Corrective Measures. Considerable money had been spent annually to replace deeply and extensively pitted economizer tubes; therefore prevention of corrosion was of paramount importance. Doing the job by injecting sufficient sodium sulphite to combine with all the dissolved oxygen remaining in the feedwater was considered but rejected because of additional plant complication, labor and the relatively large quantity of chemical needed.

Many efforts were made to improve the mechanical efficiency of deaeration with varying results. The system was thoroughly overhauled and a new and larger ejector installed but improvement was not appreciable. One difficulty, which under certain conditions resulted in extremely bad performance, was the location of the feed tank. It maintained a head of water on the 2-way valve and when the deaerator was recirculating, with this valve somewhere in its mid-position, water passed straight from the feed tank into the base of the deaerator without being deaerated.

In 1944, J A Nunn, a member of the technical staff, suggested that if decomposition of a liquid takes place when a current is passed through it the method might also prove practicable, not only to remove the free oxygen but also to destroy the water's affinity for oxygen by charging it to a potential just under electrolysis.

Experiments were started on this basis. Two standard sampling bottles, Fig. 3, were connected in series and water from the base of the deaerator passed through both for about 15 min to remove all trace of air. One bottle contained two small carbon electrodes with leads passing through the rubber stopper. The electrode bottle was placed downstream from the ordinary bottle to eliminate any possibility of the former collecting the better sample. After applying three volts potential from dry cells to the electrode bottle for one min, a standard Winkler's test was performed on both samples.

Test Results. Repeated experiments showed dissolved-oxygen content of water in the ordinary bottle was 0.10 ml per liter as against zero in the electrode bottle. It is acknowledged, of course, that at very low dissolved-oxygen concentrations the ordinary Winkler's test is not sufficiently sensitive to give accurate results below about 0.02 ml per liter. But the electrically deaerated sample remained absolutely colorless for many hours after adding the starch indicator, which appeared to justify the conclusion that the actual concentration was well below 0.02. It was apparently necessary for the electrode sample to be slightly above atmospheric temperature so cooling would create a slight vacuum in the bottle to accommodate the gas given off when potential was applied to the electrodes.

Of special interest is the length of time an electrically deaerated sample remains absolutely colorless although exposed to the atmosphere after addition of the starch indicator. Many samples have stood for over 24 hr, indicating that the water has little affinity for oxygen. In a normal sample, after titration with sodium thiosulphate, the blue color, which indicates the presence of free oxygen, returns after the sample is exposed for only a few minutes.

Plant Application. Following the success of these experiments plans were made to apply the discovery to a deaerator designed for a maximum load of 60,000 lb per hr at an inlet of 185 F.

Months of experimenting followed until nothing of the original deaerator remained except its shell because the mechanical design had to be altered radically to prevent contamination of the deaerated feedwater. The 2-way valve was eliminated and automatic control installed by substituting an internal float-controlled spray valve, Fig. 1. Various electrode formations were tried and hundreds of oxygen tests run.

Initially a central electrode in the form of a 6-in. OD steel tube was used, the top being sealed to prevent partly deaerated water passing down the center to the base of vessel. Encouraging

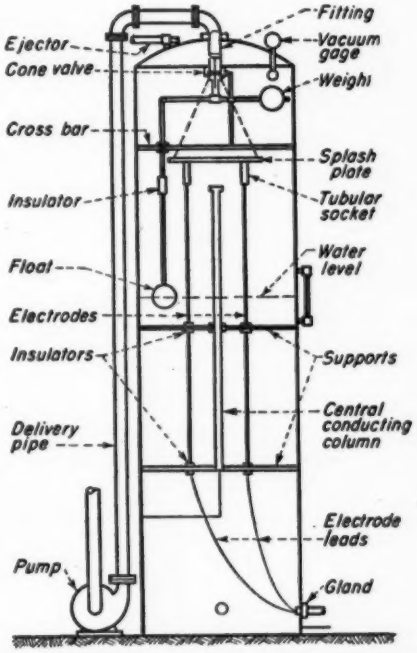


Fig. 4—Current path is shortened by installing central conducting column

but not satisfactory results were obtained. The electrode had been anchored with its top submerged about 2 ft below the water level. One theory advanced was that (1) free oxygen, released from the large volume of water between the electrode and body of the vessel was unable to escape to the vacuum space above because of the descending volume of partly deaerated water, and (2) this volume of water was absorbing the oxygen released. The effect was accumulative to saturation point at the existing temperature, which impaired the efficiency of the deaerator as a whole. The theory was substantiated by the promising results secured after raising the electrode so its sealed top projected into the vacuum space above the normal water level.

Oxygen figures of 0.02 to 0.04 ml per liter were maintained, but the object was to obtain in practice the same remarkable results secured in the laboratory. We believed that the 2½ ft of water between the electrode and vessel wall was too great so it was reduced by electrically connecting the central tube to the grounded shell and installing four electrodes equally spaced in a circle midway between the tube and shell, Fig. 4.

As completed, the pump draws oxygen-saturated water from the feed tank and delivers it through a pipe to a fitting at the top of the vessel. This fitting terminates in a cone valve. The guided valve disk is operated by a rubber-covered float acting through an insulated guide rod, which is pivoted to a lever and balance weight. The lever has a sliding connection with the conical valve so, as the float rises, the valve is moved towards its seat, and as the float falls, the valve opens.

A crossbar, having an aperture through which the float rod passes, guides the latter in its movements. A disk beneath the crossbar serves as a splash plate to distribute, in a shower, the water delivered from the spray valve, as indicated by dotted lines. The splash plate carries four tubular sockets which fit over the tops of the four electrodes. These, in turn, pass through insulated sockets in their supports. Bottom support also carries a central conducting column, which is connected electrically to the vessel. The electrodes connect by insulated leads to a cable which passes through a gland in the vessel wall.

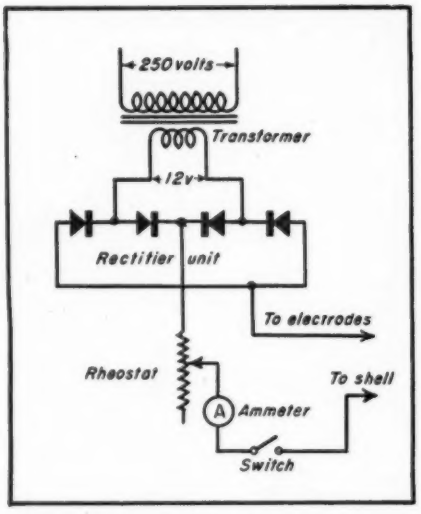


Fig. 5—Power supply comes from transformer, metal-oxide rectifier

Process Operation. In operation, water from the feed tank is continually delivered from the pump and falls in a conical sheet towards the splash plate, which breaks it up so it falls as a spray against the sides of the vessel. The ejector maintains, in the upper part, a vacuum. This removes the liberated gas and delivers it, together with the steam, to the feed tank where the heat of the steam assists in maintaining the feedwater temperature.

At first, 100 v and 25 amp were used, but it soon became evident that the heavy current caused a substantial dissociation of the water by electrolysis. Best results were obtained by applying about 12 v between the electrodes and shell, at which potential a current of about 0.8 amp flows. Original current source was the 110-v station battery, but as soon as it became evident the system required only a small amount of energy, rectifying equipment was constructed. This consists of a 250/12-v hand-lamp transformer, a 3-amp metal-oxide rectifier, together with fuses, switch, ammeter, and rheostat, Fig. 5. The whole unit occupies a space of only 12x8x8 in.

Energy required for electrical deaeration is negligible and, in addition, power consumed by the pump has been reduced about 50%. Latter saving occurs because recirculating feature of the original hookup meant that the pump always delivered at the deaerator's full-load rating, whereas with the new arrangement pump load varies automatically with water demand.

There is, of course, no need for the deaerator to be so high. But where it can be conveniently accommodated, extra height (1) provides additional storage capacity and (2) gives sufficient head to obviate the necessity for an extraction pump.

Operating Results. For nearly two years the deaerator has consistently given absolute zero dissolved-oxygen content by Winkler's test and figures ranging between 0.001 and 0.007 ml per liter by orthotolidine test—all confirmed by independent and competent power-plant chemists (see table). Following the successful outcome of experiments on No. 1 deaerator, No. 2 unit, of 80,000-lb-per-hr capacity, but otherwise identical, was converted and equipped with electrodes and splash plate with exactly the same excellent results as those obtaining with No. 1.

Splash plates consist of 3-ft-diameter mild steel plates, ⅜ in. thick. Electrodes are made from ¾-in. pipe. Owing to impingement of oxygen-saturated water spray on the splash plate, erosion and corrosion take place around the circle of impingement. Some corrosion of electrodes also occurs. Experience has shown that the useful life of the comparatively thin splash plates is about one year. Length of service could, of course, be considerably increased by using plate that is heavier or made of other material. Annual cost of renewing the plates, however, is small.

Patent application has been made for the deaerator, which is simple in operation and construction, and appears to have a wide field of application, ranging from the eradication of corrosive troubles caused by oxygen and carbon dioxide in small industrial plants, to the prevention of similar troubles in large power stations. There is no further scope for improvement in operating performance, but numerous possibilities exist for design development. Using a larger number of small electrodes makes it possible to design a comparatively small and compact unit to handle large quantities of water.

The author wishes to thank Wm C Cameron, AMI Mech E, AIEE, chief engineer of Slough Estates Limited, for permission to publish this article.

OXYGEN RESIDUAL

At various loads: current on at 3:10

Time	Temp, F	Dc, amp	Load, lb per hr	Oxygen, ml per liter
2:15	181	...	50,000	0.058
3:10	181	...	50,000	0.063
3:45	182	0.8	50,000	0.043
4:30	181	0.8	50,000	0.00
5:30	183	0.8	47,000	0.00
6:15	187	0.8	40,000	0.00
7:15	186	0.8	32,000	0.00
7:55	180	0.8	32,000	0.00

Theodore Maynz follows all power equipment from planning board to its final role as a good operating member

THEODORE MAYNZ
A POWER PERSONALITY

Study your job, get your hand in—that's the one sure way to operating know-how, says this power engineer, interviewed by a POWER editor

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▶ A BROAD BACKGROUND and first-hand operating experience are needed to be division engineer—utilities and utility distribution—for eight plants in three states. Theodore Maynz brings just that combination to his job with American Viscose Corp.

Born and raised in New York City, he received a BA from Harvard, class of 1910, with his major, electrical engineering. Back he came to Manhattan Island where he entered Columbia for a mechanical engineering degree in 1912, and a year later an MA in electrochemistry.

Maynz had already begun to apply his more than average schooling for in 1912 he served as oiler for Interboro Rapid Transit Co, and after graduation as cub engineer. He regards that experience so highly he calls himself "an engineering graduate of IRT," for he developed there a wholesome respect for the operating man's understanding of his job.

Late in 1913 he went to work for Grieve Grate Co, eventually a part of Combustion Engineering, as assistant to John Van Brunt. By 1916 he had broadened his horizon to include field testing, installing and trouble shooting.

Then in 1916 Krumbhaar and Haller brought Maynz to Trinidad, Colorado, to supervise installation of a new 5000-kw turbine-generator and rehabilitate an existing plant.

World War I drew Maynz into Army Air Forces where he gained a pursuit pilot's rating and rank of 1st lieutenant. For a time he was senior officer, engine section at Dayton.

After his discharge he went back to the power field, first with Gulf Pipeline Co, Houston, Texas, as mechanical engineer on design and operation of a central steam and electric-distribution plant for Goose Creek oil fields, and later in 1920 with Cleveland Electric Illuminating Co. By 1924 he was in charge of results, tests and efficiency for the power units of the latter system. During this span the company put in a large pulverized-fuel installation at their 70th St station, and from it he drew considerable knowledge.

Ted then decided to put all his background to work and opened his own consulting engineering office in Cleveland. This he maintained as a one-man enterprise specializing in industrial rehabilitation programs and trouble shooting. Along came 1933 and the depression. For the next three years he sold and serviced brewery equipment; then a chance opened for him to return to engineering.

Maynz joined a group of engineers engaged in evaluation of New York City public utilities for tax purposes under supervision of Department of Taxes and Assessments. His next move was to the consulting engineering firm of Gibbs and Hill as steam engineer. Next, he went to Jackson Moreland Co, who sent him to Boston Edison on a construction program. This assignment put him actively back into operation and construction. For Jackson Moreland, he took over the night shift for the initial operation of the new 1200-psi 910-F equipment at Boston Edison. Soon thereafter, in 1939, Maynz went over to his present connection, the American Viscose Corp.

LINKING OPERATION AND DESIGN

His work involves close cooperation with design and operating departments. All new equipment of any magnitude, new plants or major extensions and improvements have their origin with the engineering department. Here Maynz' broad background contributes in the transition from this planning stage to the final plant operating member. His responsibility does not stop at this point for he stands ready to (1) help in clearing up operating troubles and (2) give direct trouble-shooting aid in time of emergency.

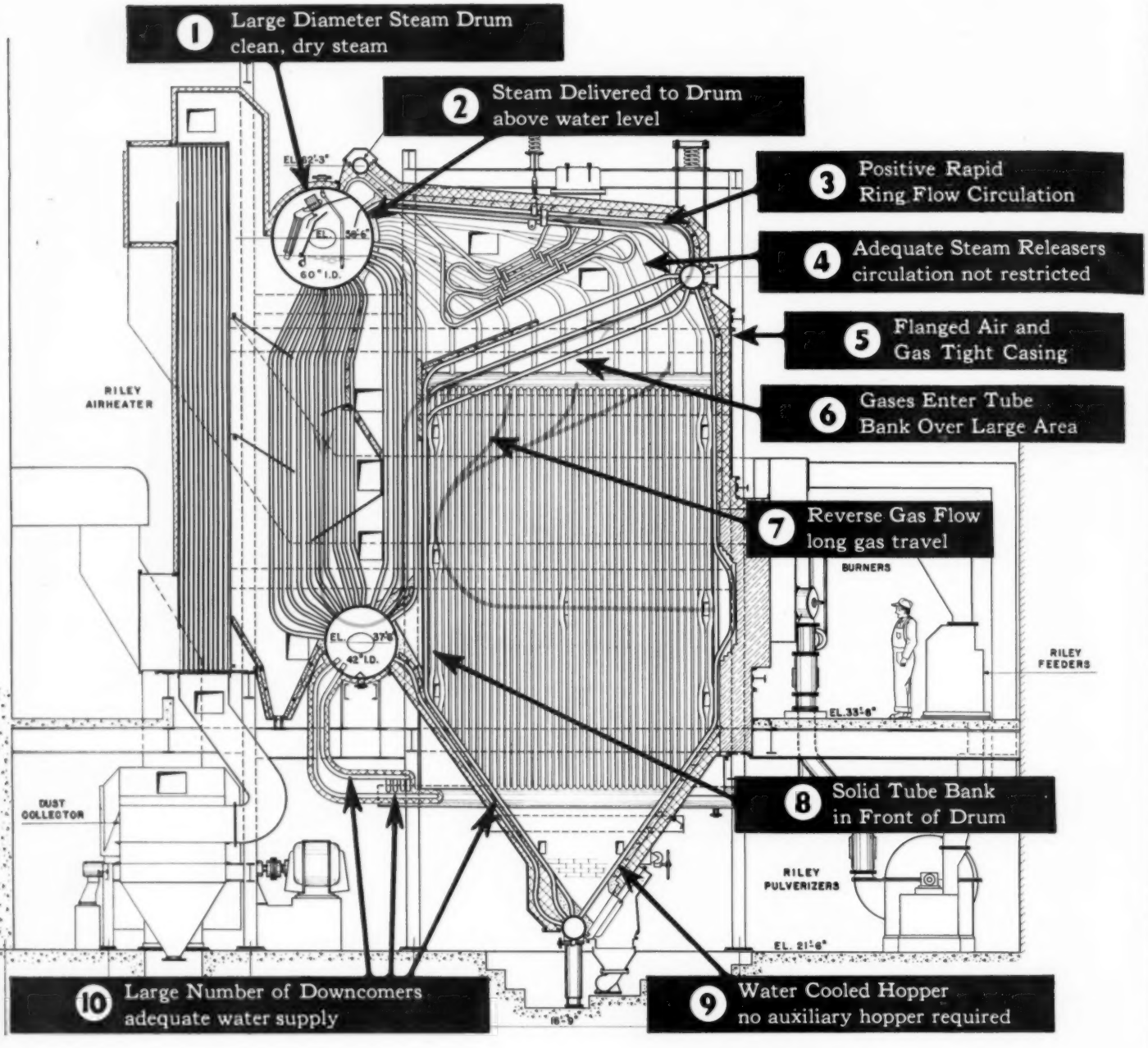
A registered professional engineer in the state of New York, he has definite opinions on the role that engineering societies, technical publications and job experience play in forming an engineer. He believes an engineer just out of school should move three to five times into widely different jobs.

Maynz' credo stresses getting into the plant, the operating phase of the business. "Get your hands dirty, follow your business in all its phases, such as ash handling, boiler repairs, operation. This operating know-how should be bolstered by joining in the work of engineering societies, studying on the outside, drawing heavily from the technical press.

Ted pays more than lip service to this credo for he was secretary and then chairman of the ASME Cleveland section, a contributor to the technical press (in POWER as far back as 1915) and a speaker before technical societies.

Ten good reasons why so many

*There are many more


1 Large Diameter Steam Drum clean, dry steam
2 Steam Delivered to Drum above water level
3 Positive Rapid Ring Flow Circulation
4 Adequate Steam Releasers circulation not restricted
5 Flanged Air and Gas Tight Casing
6 Gases Enter Tube Bank Over Large Area
7 Reverse Gas Flow long gas travel
8 Solid Tube Bank in Front of Drum
9 Water Cooled Hopper no auxiliary hopper required
10 Large Number of Downcomers adequate water supply
RILEY AIRHEATER
DUST COLLECTOR
BURNERS
RILEY FEEDERS
RILEY PULVERIZERS
EL. 33'-6"
EL. 21'-6"
60" I.D.
42" I.D.

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1 Large diameter steam drum

With Riley Steam Generating Units large steam drums are furnished to provide a large space in which steam can readily separate from the boiler water. Such design with the efficient Riley steam purifier and delivery of steam above the water level assures clean dry steam.

2 Steam delivered to drum above water level

Practically all steam generated by the water walls and boiler is delivered to the steam drum above the water level where the steam can separate freely from the water, resulting in a steady water level and dry steam.

3 Positive rapid ring flow circulation

With Riley units positive rapid circulation is obtained because all tubes exposed to high temperatures carry upward flow of water and steam and because areas in the system are of proper size to cause no restriction of circulation.

4 Adequate steam releasers

Adequate steam release tubes are provided so as to permit free release of steam to the steam space of the drum without restriction to flow.

5 Flanged air and gas tight casing

The flanged steel casing furnished with Riley units assures permanent air and gas tightness, preventing air infiltration. The heavily insulated setting minimizes radiation losses. The construction of the setting reduces setting maintenance to a minimum.

6 Gas enters tube bank over wide area

Furnace gases enter the boiler tube screen which extends over the entire furnace so that gas flow to the boiler proper is not restricted. This feature minimizes the possibility of objectionable slag formation among the boiler tubes.

7 Reverse gas flow

The furnace gases reverse themselves before entering boiler, providing a longer flame travel and more complete combustion in the furnace.

8 Solid tube bank in front of drum

The rear water wall tubes extend from the lower header to the front boiler header, forming a smooth solid water wall in front of the lower drum, preventing the formation of slag at the lower drum.

9 Water cooled hopper

The water cooled hopper bottom not only assures the flow of ash to the bottom of the hopper but also affords a complete enclosure, eliminating the cost of a refractory hopper. This should be taken into account when considering relative costs.

10 Large number of downcomers

A large number of water downcomers and large bottom water wall headers assure an adequate supply of water to all water wall tubes.

These are just a few of the main distinctive features of Riley Steam Generating Units which assure continuous satisfactory operation at high efficiency. Riley units had to be good for Riley to climb so rapidly to a position of leadership in the boiler industry. You can rely on Riley. Any Riley user will tell you so.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

A Few Recent Riley Contracts

★ Repeat Orders

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Public Service Co. of Ind.
Dresser Station, Terre Haute, Ind.

Public Service Co. of Ind.
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★ Iowa-Illinois Gas-Electric Co.
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★ Otter Tail Power Co.
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★ Otter Tail Power Co.
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Southwestern Public Service Co.
Borger, Texas

★ Upper Michigan Power & Light Co.
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★ Central Ohio Light Co.
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★ Celanese Corp. of America
Rock Hill, S. C.

★ Celanese Corp. of America
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★ Standard Oil Co. of Calif.
Richmond, Calif.

★ Standard Oil Co. of Calif.
El Segundo, Calif.

★ Container Corp. of America
Philadelphia, Pa.

★ Hooker Electro Chemical Co.
Niagara Falls, N. Y.

★ Dow Chemical Co.
Freeport, Texas

★ Gaylord Container Corp.
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Champion Paper & Fibre Co.
Canton, N. C.

★ Scoville Mfg. Co.
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★ National Lead Co.
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★ Standard Oil Co. of N. J.
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★ Northern Paper Mills
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★ Nicholson File Co.
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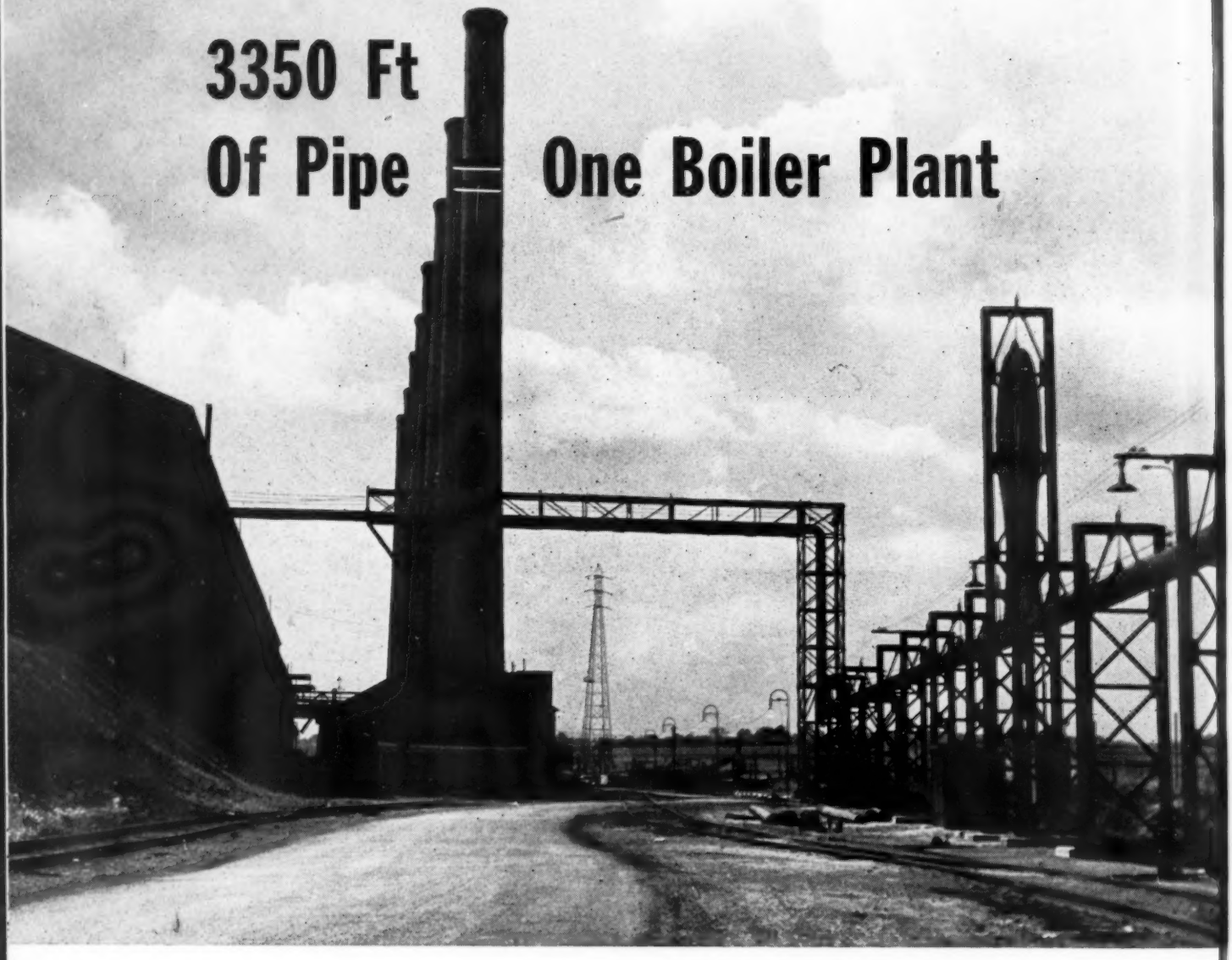
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

RATING UNITS •

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

3350 Ft Of Pipe = One Boiler Plant



Rugged insulation on an all-welded pipeline made possible overhead construction to clear obstructions between point of steam demand and plant with excess steam capacity. Here's how one company eliminated the need for hard-to-get equipment

► AN OVERHEAD PIPELINE solved the problem when Jones & Laughlin Steel Corp needed steam in the reconversion of the open-hearth and rolling-mill division of their Otis plant in Cleveland. Thus, by making excess steam capacity available at another location, 3350 ft of pipe took the place of new boiler facilities. Experience has demonstrated the soundness of this solution at a time when the tight supply and delivery situation made procurement of new generating facilities too slow for the desired schedule.

The steam was needed for expanding mill operations, with some incidental heat and power uses. More than half a mile from the point of need, J & L had a complete steam-power division supplying other plants and operations. Between this source of steam and the Otis plant, however, the 3000 ft of space was crossed by more than a dozen rail lines, roadways, service lines and the like, making installation of underground piping difficult.

These obstructions could be bypassed by suspending the line from the spans of one of Cleveland's major bridges across the Cuyahoga River. This meant construction that would insure trouble-free service without need for frequent inspection and repair. Specifications called for a total of 3350 ft of 14-in. pipe of $\frac{3}{8}$-in. wall thickness. With all joints welded, and proper provision for expansion, the line formed a unit free from leaks.

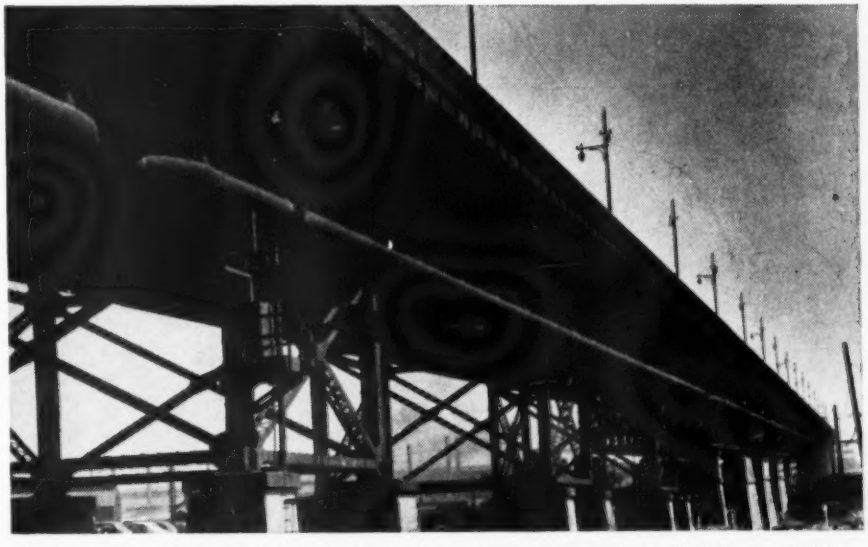
Insulation of the line proved a major consideration. J & L engineers selected blanket-type mineral wool covering as offering the desired combina-

On opposite page: Pipeline at point of delivery to open hearth and rolling mill; note expansion loop at right, crossover bridging at center. Above: View at delivery end; typical construction of line not slung from bridge

tion of (1) fibrous structure to resist vibration and fracture, and (2) light weight with good insulating characteristics. It was applied 2½ in. thick, wire-faced and metal-lath-backed. All lath joints were securely fastened with clinched pig rings. Two layers of 75-lb asbestos felt, asphalt-impregnated, provided vapor and weather sealing. The first layer was cemented with 3-in. lapped seams and strapped on 12-in. centers with signode fasteners. The outer layer was similarly lapped, hot-mopped with asphalt and strapped on 12-in. centers; the signode straps were spaced to allow 6-in. separation between inner and outer supports. After the line was suspended and all welding gaps covered, the entire length was wire-wound and brush-coated with a heavy layer of weather-resistant paint.

Performance of the line demonstrated the wisdom of thorough insulation. Boiler pressure is 235 psi; pressure at the delivery point is 215 psi. Temperature drop in the completed line proved to be only 10-15 F against an anticipated drop of 70-90 F. In more than a year's operation, there has been no sign of deterioration of the covering. The line even survived without harm heavy maintenance and construction work on the bridge, during which it was inevitable that tools and other heavy objects would be dropped on the line. A thorough inspection of the asphalt-felt cover showed only a few breaks, which were corrected without disturbing service. No perceptible variation in performance was noted before the breaks were fixed. Insulation cost about $5.25 per ft.

Installation of this line avoided need for adding boiler capacity at a time it would have been difficult to obtain quickly, and permitted utilizing otherwise excess capacity. The performance of the line, and the benefits resulting from its construction, justify further consideration of steam transmission.



Closeup of section of 3000-ft pipeline shows how it was suspended from a bridge over the Cuyahoga River to overpass the rail and utility lines. The soundly designed covering withstood the wear and tear of maintenance work on the bridge

How to work a—S

How to use the capacity chart to select the right size trap for the job!

Because good trapping starts with selection of the right trap for the job, Armstrong has provided all the data necessary for correct trap selection in the Armstrong Steam Trap Book. The Capacity Chart reproduced here is taken from this handy reference work. By means of this chart, any engineer can select the correct traps for his requirements. Here are typical problems showing how the chart is used:

problem 1

Given: 100 psi. constant pressure. 800 lbs./hr. condensing rate. 2 to 1 safety factor required.*

Solution: Multiply the condensing rate by the safety factor. $2 \times 800 = 1600$ lbs./hr. Hence, a trap with a continuous discharge capacity of 1600 lbs./hr. at 100 psi. is required. Follow up the 100 pound pressure line on the chart until the 1600 pound capacity point is reached. This point is within the capacity range of the No. 212 bottom inlet, or 812 side inlet Armstrong Traps. (The capacity curve is shown here in red for your convenience.)

problem 2

Given: An evaporator condensing 6000 lbs./hr. at 50 psi. when the steam is first turned on, but condensing only 1000 lbs./hr. at 150 psi. at the end of the process. Safety factor of 2 to 1 required at the *minimum* pressure differential.

Solution: Referring to the chart, the No. 216 Armstrong Trap suitable for 150 psi. pressure has a capacity of 12000 lbs./hr. at 50 psi. This provides for the 2 to 1 safety factor and is, therefore, the correct trap for the job.

*The Armstrong Steam Trap Book provides recommended safety factors for different services and handy tables to help you calculate condensing rates. Other useful data included are: hookup diagrams; do's and don't's; trouble-shooting tips; prices and specifications. You're welcome to a copy. Write ARMSTRONG MACHINE WORKS, 812 Maple Street, Three Rivers, Michigan.

Why It's A Good Idea To Buy ARMSTRONG Traps

DEPENDABLE. Ordinary dirt and scale are carried right through, won't clog or stick. Valve and seat are chrome steel, hardened, ground and lapped. Bucket assembly is 18-8 stainless. Long wearing, nothing to get out of order.

NO STEAM LOSS. No steam escapes even when there is no condensate load.

AUTOMATIC AIR ELIMINATION. All air and non-condensible gases automatically discharged ahead of condensate.

NO LAGGING BEHIND CONDENSATE LOAD. Condensate is discharged as fast as it accumulates. Equipment stays hot. Lines are kept dry.

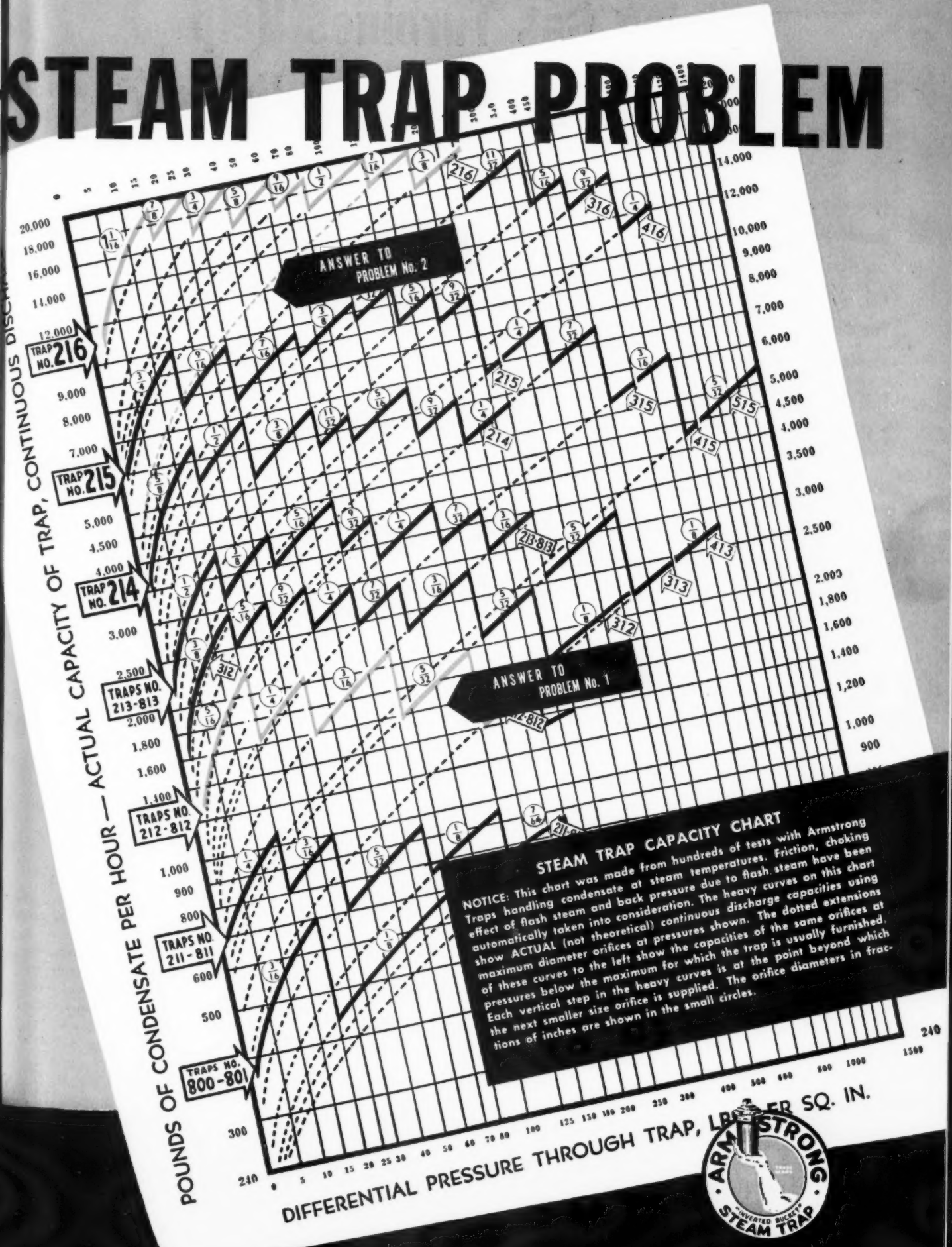
A TRAP FOR EVERY JOB. Side inlet or bottom inlet; cast semi-steel or forged steel; large or small.

GUARANTEED to give complete satisfaction. After you have installed Armstrong Traps you can forget about them for a long time.

ARMSTRONG *Inverted Bucket* **STEAM TRAPS**

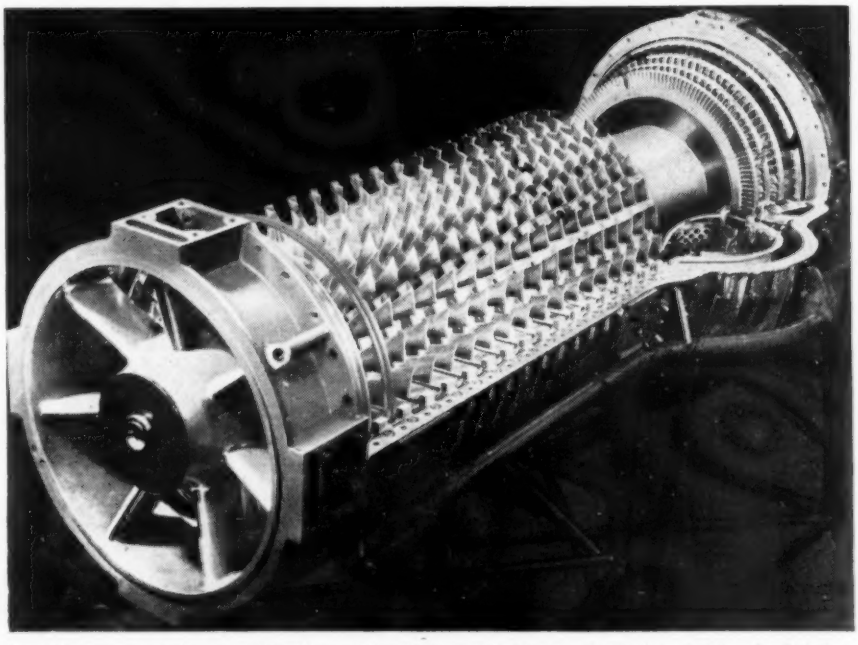
Over a Million in use for **POWER. PROCESS. HEATING**

STEAM TRAP PROBLEM


ANSWER TO PROBLEM No. 2
ANSWER TO PROBLEM No. 1
TRAP NO. 216
TRAP NO. 215
TRAP NO. 214
TRAPS NO. 213-813
TRAPS NO. 212-812
TRAPS NO. 211-811
TRAPS NO. 800-801
POUNDS OF CONDENSATE PER HOUR — ACTUAL CAPACITY OF TRAP, CONTINUOUS DISCH
DIFFERENTIAL PRESSURE THROUGH TRAP, LBS. PER SQ. IN.
STEAM TRAP CAPACITY CHART
NOTICE: This chart was made from hundreds of tests with Armstrong Traps handling condensate at steam temperatures. Friction, choking effect of flash steam and back pressure due to flash steam have been automatically taken into consideration. The heavy curves on this chart show ACTUAL (not theoretical) continuous discharge capacities using maximum diameter orifices at pressures shown. The dotted extensions of these curves to the left show the capacities of the same orifices at Pressures below the maximum for which the trap is usually furnished. Each vertical step in the heavy curves is at the point beyond which the next smaller size orifice is supplied. The orifice diameters in fractions of inches are shown in the small circles.
ARMSTRONG
"INVERTED BUCKET" STEAM TRAP

Flying Gas Turbines Help Develop Earth-Bound Units

Intensive wartime gas-turbine development for aircraft propulsion is now being adapted to building American units for locomotive drive and for stationary power generation



Preliminary design of Northrop-Hendy's Turbodyne. Left to right, air intake, 17-stage axial-flow compressor, combustion chamber and four-stage gas turbine

▶ WHAT IS BELIEVED to be the most powerful aircraft gas turbine yet built in this country is on test at Northrop Field in Hawthorne, Calif. Plans now maturing will put a suitably modified version of this unit on a diesel-locomotive chassis, made available by the Union Pacific Railroad. This may prove to be the first gas-turbine locomotive on the rails in the U. S.

Northrop Aircraft, Inc began this development nearly seven years ago and in 1941 accepted a joint Army-Navy contract to design a complete gas-turbine plant, and build and test a compressor for it. In 1943, another contract was awarded to build two complete units, one for ground test and one for flight.

With facilities taxed by a heavy war-production program, Northrop joined with Joshua Hendy Iron Works in 1944 to form Northrop-Hendy Co, a subsidiary charged specifically with further gas-turbine development. Under leadership of A J Phelan, chief engineer for Northrop-Hendy and chief of power-plant research for Northrop Aircraft, the two preliminary units were built and tested to destruction. A further contract with the Army authorized construction of four complete power plants.

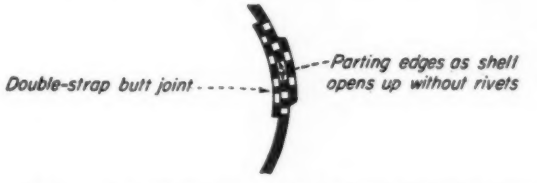
Reliability and Simplicity. The current design, from which later production models will stem with only detail changes to take advantage of data gained in testing and to allow for application variations, stresses reliability and simplicity. The builders believe there is definite need for an aircraft unit designed conservatively for greater capacities than today's largest power plants. Built for turbo-prop operation, such an engine seems well suited for commercial aircraft and for adaptation to fields other than aircraft.

Although details are still restricted on the current unit it has been described as having a 12-stage axial compressor with a 7:1 pressure ratio; this indicates an exceptionally high pressure rise per stage. Tests show unusually high efficiency. The compressor discharges into eight "can" type combustors, of extremely simple design, grouped around the drive shaft. The turbine designed for 1350-F inlet temperature has three stages of 50% reaction blading.

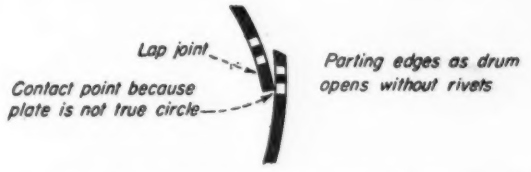
At 7100 rpm this unit is expected to produce 7000 to 8000 hp, about 75 to 100% more than any unit announced in this country, and 40 to 60% more than the 5000-hp British "Nene" engine built by Rolls-Royce. Compressor blading is aluminum for the first stages and steel for the last; blades are machined from bar stock, and blade shapes are altered slightly from stage to stage. Turbine blades are forged from one of the new high-temperature-resistant alloys.

Tests on the Rails. It was felt that a suitably modified version of this turbo-prop unit should be placed in a locomotive on the rails as soon as possible to study its service characteristics. To this end, Union Pacific turned over to Northrop-Hendy a 2100-hp 2-cab diesel locomotive; one cab carried a 1200-hp diesel engine and generator and the other a 900-hp plant. According to present thinking, the gas turbine will go into the larger cab with both generators, while the smaller cab will be suitably weighted so its traction motors may be used. Derating the present gas-turbine design to the 2100-hp of the locomotive will permit operation at much lower temperature and speed, which will extend its useful life to perhaps as much as 30,000 to 40,000 hr. J L Ray, assistant chief engineer, directing this work, formerly worked on the Annapolis gas turbine and locomotive applications for the Allis-Chalmers Manufacturing Co.

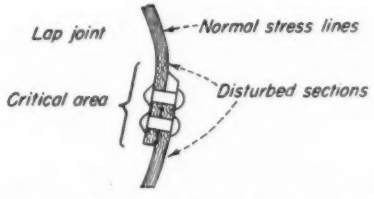
(*Continued on page* 144)



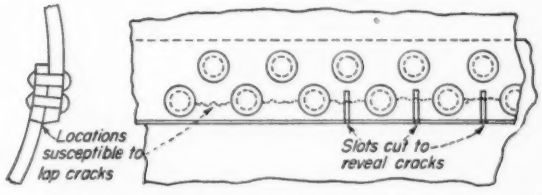
1 Butt and double-strap joint gives uniform force



2 Lap joints produce nonuniform forces on plates



3 Irregular stress lines in plates of lap joints



4 Slotted seams show hidden cracks in lap joints

HIDDEN DANGER in Lap Joints

Working stresses produce invisible cracks in longitudinal lap-riveted joints of cylindrical boiler shells, says Harry M Spring, who lists three ways to investigate suspicious joints

▶ IN STATES THAT HAVE ADOPTED the ASME *Code for Power Boilers*, or similar regulations, most operators are aware of the limitations for constructing new boilers with longitudinal lap-riveted joints. The design is taboo for shells or drums exceeding 36 in. diameter and is limited to a maximum pressure of 100 psi.

A first thought when considering the limitations is strength or relative efficiency of the joint. Usually, lap-riveted joints are not so strong as welded or butt and double-strap joints. It is a fact, however, that by juggling rivet pitch and diameter, a lap joint may approach 75% efficiency while a single- or double-riveted butt joint may fall somewhat below this value.

Reason for Objections. Disfavor of lap joints goes further than actual efficiency. To understand the reason refer to Fig. 1, where a butt and doublestrap joint is "opening up" under pressure, unrestrained by rivets. Since the plate was rolled to a true circle, the abutting edges would be expected to separate first, almost as under a straight pull.

This is not so with a lap joint as shown in Fig. 2. The lip of one edge must ride across the inner face of the adjacent lap until it comes free. This is shown by the lack of symmetry in flow of stress lines in Fig. 3. Here the internal pressure develops a "hinge-like" bending stress concentrated in critical parts of the lap joint. Each variation in pressure or, in fact, in temperature causes a corresponding variation in the stress.

Everyone is familiar with the results of repeated bending of a piece of wire. It soon breaks. Repeated bending of the plate in a lap joint by the variations in pressure over a period of years causes exactly the same action. The defect is progressive and develops as a *lap crack*. Fig. 4. Great hazard is that cracks hidden beneath the lap may progress to point of failure with no warning whatsoever. This point of failure has caused, not infrequently, a disastrous explosion.

To guard against this risk a number of states have included in their boiler laws a rule that limits to 50 psi any boiler having a lap-riveted longitudinal joint after it reaches the age of 30 years. Reason for this rule is obvious. Only by reducing stress value may metal, which is approaching its limit of fatigue endurance, avoid failure.

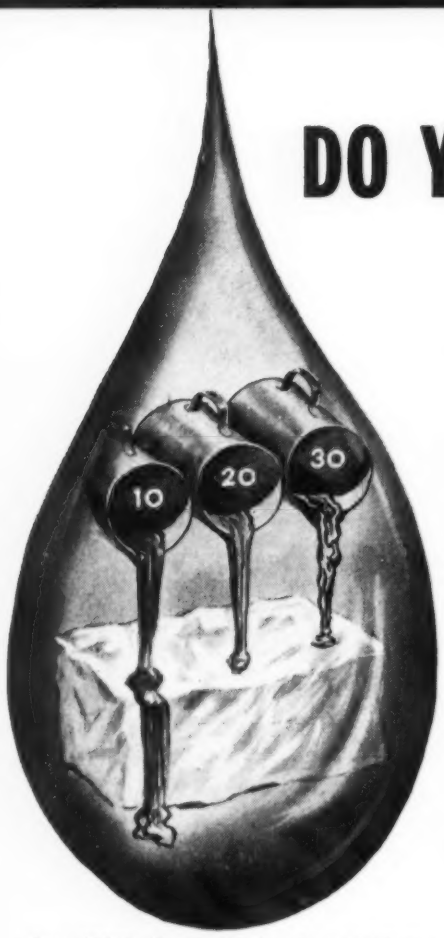
Testing for Cracks. There are three methods of investigating suspicious lap-riveted joints: (1) Employ radiography by X-ray or gamma ray. This generally entails considerable expense and requires services of those familiar with the equipment. (2) Slot the seam to expose a hidden crack, as in Fig. 4. Subjecting boiler to hydrostatic test after lap has been slotted should reveal by leakage the presence of a crack. (3) Remove rivets and etch the walls of rivet holes so they can be scanned with a magnascope. Sometimes this method is combined with the others mentioned. It is usually not practicable to remove all rivets, and unless a suspicious area manifests itself by leakage, one may be at a loss as to which rivets to remove.

A telltale that may well indicate presence of a lap crack is leakage. From a lap-riveted longitudinal joint, leakage may be serious. If it develops, shut boiler down at once for thorough inspection and investigation.

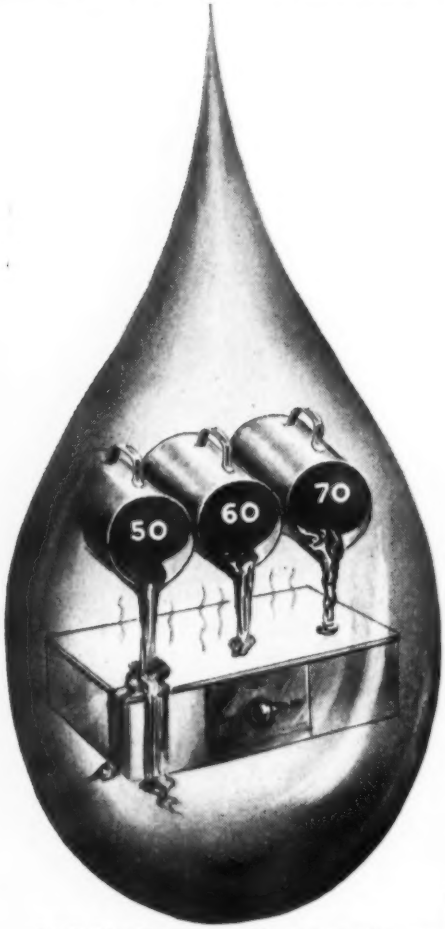
The foregoing hazards and limitations of a lap-riveted joint do not apply except when it forms the longitudinal seam of a cylindrical portion of a shell or drum. In boilers of the economic type, these limitations apply only to the lap-riveted joint in the barrel.

DO YOU KNOW THE VISCOSITY

Each classification of SAE numbers for lubricating oil takes in a wide range of viscosities. C M Larson, chief consulting engineer, Sinclair Refining Co, explains the limitations of these numbers and tells how to adapt them for some industrial uses



Low SAE oils are for low temperatures



SAE 50, 60 and 70 classified oils are for high-temperature applications

▶ SINCE THE VISCOSITY of lubricating oils influences their application, the user needs help in classifying the various grades in terms of viscosity. The general designations of light, medium and heavy are not definite enough because they vary with different manufacturers. Accordingly, the Society of Automotive Engineers has standardized ranges or limits, called SAE viscosity numbers. They constitute a classification of lubricating oils in terms of viscosity only, without considering other quality factors.

Crankcase Oil. SAE numbers for crankcase-oil classification are based on viscosity limits at two temperatures determined by saybolt seconds universal (ssu) units. The 10, 20 and 30 SAE range is for ssu values taken at 130 F, whereas the 50, 60 and 70 range is for 210 F. Minimum viscosity range of SAE 40 is set at 130 F, and maximum at 210 F. The chart on the opposite page shows viscosity curves for 130 and 210 F, with SAE classifications indicated to show the range included in each. Table I shows the ssu range for the SAE numbers for crankcase lubricating oils, as indicated in the chart on the following page.

To take care of cold-starting condi-

TABLE 1—CRANKCASE OIL CLASSIFICATION

SAE viscosity number	Viscosity Range, Saybolt Seconds Universal			
	At 130 F		At 210 F	
	Minimum	Maximum	Minimum	Maximum
10	90	Less than 120	...	.....
20	120	Less than 185	...	.....
30	185	Less than 255	...	.....
40	255	.....	...	Less than 80
50	...	.....	80	Less than 105
60	...	.....	105	Less than 125
70	...	.....	125	Less than 150

TABLE II—LOW-TEMPERATURE CRANKCASE OIL

SAE viscosity number	Viscosity range at 0 degrees F, Saybolt Seconds Universal	
	Minimum	Maximum
10 W	5,000	10,000
20 W	10,000	40,000

TABLE III—TRANSMISSION AND AXLE LUBRICANTS

SAE viscosity number	Viscosity range, Saybolt Seconds Universal	Consistency must not channel in service at degrees F
80	100,000 sec at 0 F, maximum	Minus 20
90	800 to 1500 sec at 100 F, "	Zero
140	120 to 200 sec at 210 F, "	Plus 35
250	200 sec at 210 F, minimum	.....

OF YOUR SAE LUBRICATING OIL?

tions in winter, automotive manufacturers added the classifications 10W and 20W, based on a viscosity range at O F, as in Table II. Some SAE 10 oils of high Viscosity Index (V-I) also classify as 10W lubricating oils. The same is true of higher viscosity index SAE 20 oils, classifying as 20W oils. For a description of V-I see POWER, Aug. 1946, p 68, "Viscosity: Most Important Property of Lubricating Oil," by C M Larson.

Transmission and Axle Oils. SAE numbers for transmission and axle lubricants have a different range, which is shown in Table III. SAE 80 grade for low-temperature operation has its viscosity range at O F. The grade most often used, SAE 90 range, classifies at 100 F, whereas the heavier grades, 140 and 250, are at 210-F viscosities.

USED IN INDUSTRY

For want of other means, power and industrial plants use SAE viscosity numbers for equipment recommendations. They are used generally to describe lubricants for all purposes. For applications such as turbine oils, which fall within the SAE 10 viscosity numbers, the range is either too wide or too coarse. Certain high-speed spindle oils also fall in this category. In such cases manufacturers specify more exact viscosity ranges than those for equivalent SAE numbers. The addition of the more exact range as V-I limits the oil to certain crudes or solvent-refining processes.

The designer and machine builder consider a suitable viscosity classification, such as V-I, desirable because it enables them to specify the general type of oil required for lubricating their machines. The refiner and distributor of lubricants also benefit from the improved classification. In addition, this system makes it easier for the customer and designer to understand each other's needs.

In selecting a suitable mineral oil of proper viscosity there are three factors to consider: (1) temperature (2) pressure and (3) rubbing speed.

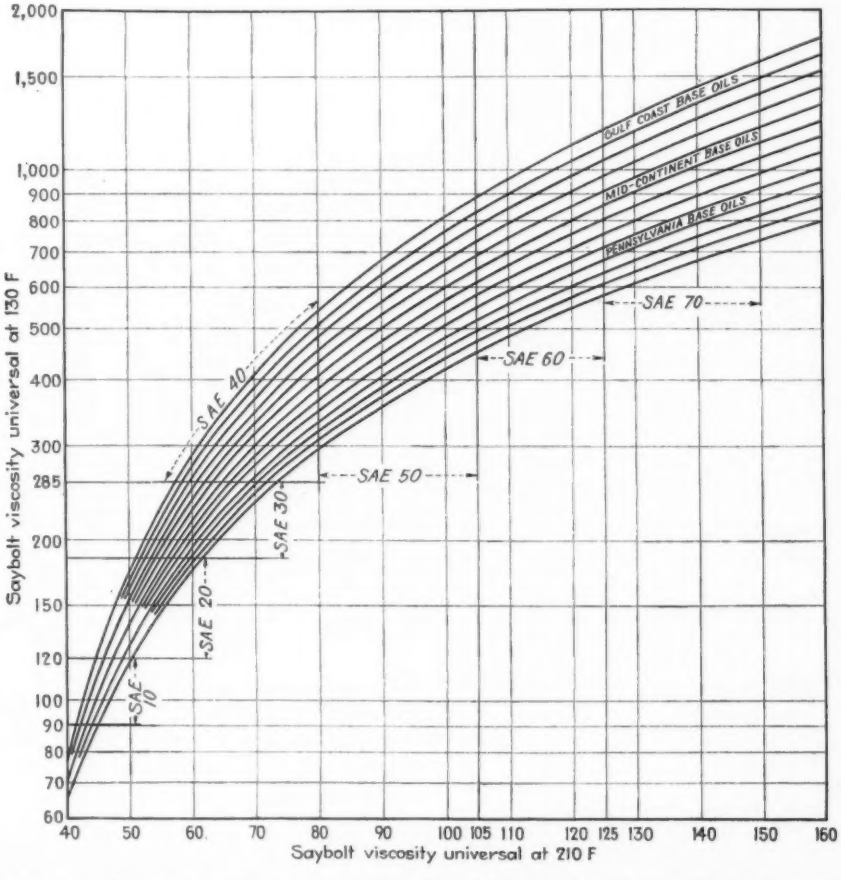
Temperature Factor. This factor refers to the working temperature of the surface to be lubricated, and the viscosity should be chosen accordingly. If we have two bearings that are identical, one working at 100 F, and the other at 150 F, viscosity at the working temperature should be the same. Consequently the oil will be different at 100 F, as the one for the 150-F running temperature will be heavier.

Pressure and Rubbing Speed. With regard to pressure, the important thing is to get an oil whose viscosity is high enough to prevent it from being squeezed out under the maximum load to which the surface is subjected. If the bearing or machine is using too much oil a heavier or higher viscosity will reduce oil consumption. This saves oil but increases friction slightly.

With high speeds a low-viscosity or thin oil is usually recommended. Bearings or surfaces of this high-speed type are generally designed so as not to have high pressures. Thus a light oil can be used without danger of seizure or of squeezing out the oil between the journal and bearing.

Intermittent Loads. In turbine bearings best conditions prevail for the use of light low-viscosity oils. Here speed is high and bearing pressure is not only small but is also steady and uniform in character. In a reciprocating engine, rubbing speed is much slower and bearing pressures intermittent. The reciprocating action intensifies the bearing pressure and squeezing-out effect. Saving quality is that while this pressure is on one side of bearing, the oil film is given an opportunity to form on the opposite side.

Because of this action, the reciprocating-engine bearing needs a fairly heavy high-viscosity oil to give an increased cushioning effect and to pre-



SAE classification of oils shows the range of each, as based on saybolt seconds universal viscosity limits at the two basic temperatures of 130 and 210 F

vent wasting oil. Direct-connected steam turbines, fitted with circulating systems, give the nearest approach to perfect lubrication and lowest viscosity at operating temperatures. Operating temperatures of bearings and equipment lubricated with straight mineral oils have minimum viscosities allowable for safety. Table IV shows a general lubrication chart for various industrial uses and recommended SAE ranges of lubricating oil.

Knowing operating temperature and machine type and service, viscosity limits can be checked by viscosity-temperature curves for the oils.

VISCOSITY IS A SIZE

In reality viscosity is a size. For a given thickness, a certain load can be carried safely. To permit lower viscosities at operating temperatures or to allow greater loads without seizure of bearing surfaces using the same viscosity, extreme-pressure lubricants are required. Compounded lubricants of this nature are effective in raising the load-carrying capacity to a value several times that for mineral oils of the same viscosity. The formula and nature of such extreme-pressure lubricants depend upon the type of equipment, service conditions and composition of the metals.

TABLE IV—LUBRICATION CHART

Machine	*SAE oil*
Turbine-generator circulating system	Below 10
Geared-turbine circulating system	20
Turbine ring oiled, bearing cooled	20
Turbine ring oiled, no cooler	30
Steam-engine cylinders, saturated steam	60, 70
Steam-engine cylinders, superheated steam	Above 70
Steam-engine bearings, circulating system	10, 20, 30
Roller and silent chains	10, 20, 30
Air and gas compressors	10, 20, 30
Refrigeration compressors	10, 20, 30
Diesel engines	10, 20, 30, 40, 50
Machine-tool lubrication, circulating systems	10
Spindles, high speed	Below 10, 10
Shafts, sleeve bearings	10, 20, 30
Inclosed gears, low speed	40, 50
Planetary gears	30, 40
Gear motors, gears	40
Bevel gears	40, 50
High-speed gears	10 to 20
Worm gears, continuous low speed	Above 70
Worm gears, continuous high speed	70
Open-type gears, hand oiled	60
Open-type gears, brush or paddle	Above 70
Pump bearings	10, 20, 30
Electric motors	10, 20
Flexible couplings, oil lubricated	70

Destructive Testing Designs Gas Turbines

► IN A "BOMBPROOF" DUGOUT at the Westinghouse Research Laboratories, scientists will soon begin to explode whirling red-hot metal disks to determine the maximum strength of parts for aircraft jet engines. Disks of specially developed alloys, one ft in diameter and one in. thick, will be heated to temperatures of 1400-F and spun at 35,000 rpm until they fly apart under the combined effects of centrifugal force and heat.

The disks will be attached to the shaft of an ultra-high speed motor, which is located ten feet below the floor of the specially constructed dugout. Electric heating coils produce the high temperatures needed for testing. During the test runs the 32-lb disks are covered by thin steel hoods from which air has been evacuated to reduce friction. The hoods are built of ⅛-in. steel to allow flying fragments to pierce them easily. Heavier steel would seriously damage the fragments and prevent accurate study of the type of fracture.

As the heated disk spins continuous measurements will be made of its temperature. To devise methods of doing this posed a difficult problem. Since the disk whirls at 35,000 rpm any thermocouple attached to the outer rim will have a centrifugal pull about 190,000 times its own weight and must be fastened strongly enough to resist a pull of many thousand pounds. A special welding process solved this problem.

Periodic measurements will also be made of the expanding diameter of the revolving metal disk. Under high stress and temperature all metals tend to creep and with the very narrow clearances in gas turbines the creep rate must be known.

These destruction tests are aimed at revealing the ultimate strength of alloys now used in gas-turbine rotors for jet-engine application. In actual service these elements are subjected to very high stress and temperatures. It is planned to simulate and even exceed those conditions until the metal disintegrates in the hope of deriving a set of principles from which behavior of alloys at any temperature and speed can be predicted.

Such knowledge of the physical limitations of metals will be valuable both in designing present aviation gas turbines and in pointing out the way to developing new and stronger alloys for all types of gas-turbine applications, marine, locomotive and stationary units.

THE OPERATING ENGINEER

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Why Not Take 'Before and After' Photos?

A box camera can be an operating aid, says C T Smith, Ebasco Services. Let shots record a problem like this one of coal segregation, showing fuel bed under fire and no-fire conditions

►A CHAIN-GRATE STOKER burning a Midwestern coal indicated serious coal segregation. We felt that a permanent record of this problem as it appeared at the firing bed would help in finding a solution. Accordingly, we decided to photograph the furnace interior both with and without fire.

Preliminary steps for no-fire condition included (1) closing up all furnace openings—access doors, inspection ports (2) lowering the coal gate until it touched the grate. Any daylight admitted would fog up a picture.

A simple box camera, loaded with extra-sensitive-film (Super XX or Super Pan) and propped up on the grate at rear of furnace, completed preparations. Pictures of the arch required external lighting. An assistant held a flashlight at the corner of the arch. A flash bulb with a white-paper reflector was arranged in an extension cord. Finally the camera was set for a time exposure and the shutter opened. Outside the boiler an assistant plugged in his end of the extension cord to flash the bulb and take the picture. The camera shutter was then closed.

Fuel-Bed Pictures. For the fire pictures a filter was necessary. It was found possible to hold the fireman's hand mask with the inspection glass over the camera lens. This mask, an ordinary type similar to a welder's mask, carries a standard dark brown glass through which the fireman views his fire. One further preparatory move was to station an assistant to open the access door, and the snapshot was made with a 1/25-sec exposure.

This procedure secured the accompanying pictures, which illustrate for both fire and no-fire conditions, the

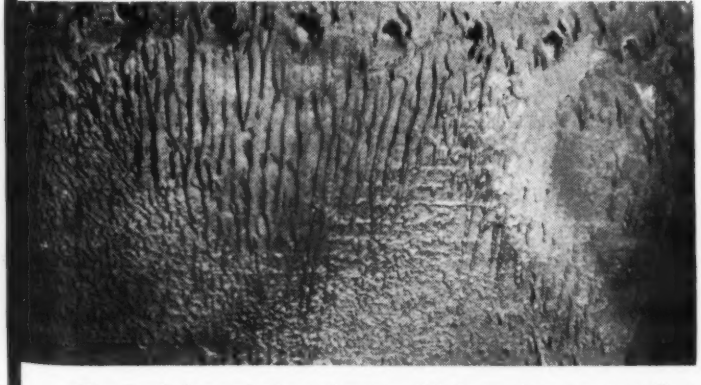


Fig. 1—Before photos, above and below, show segregation. Note streaks of unburned coal, smoke, fuel-bed thickness

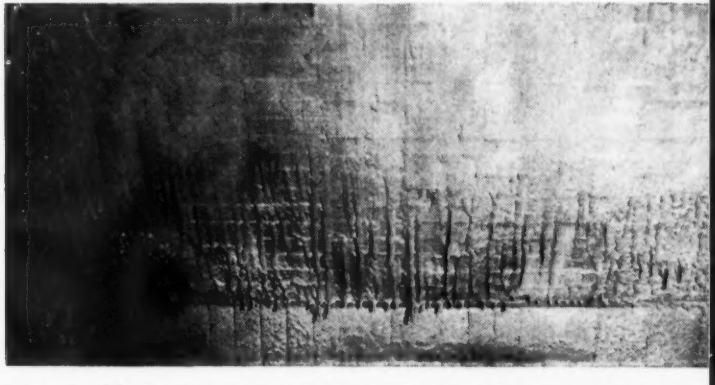
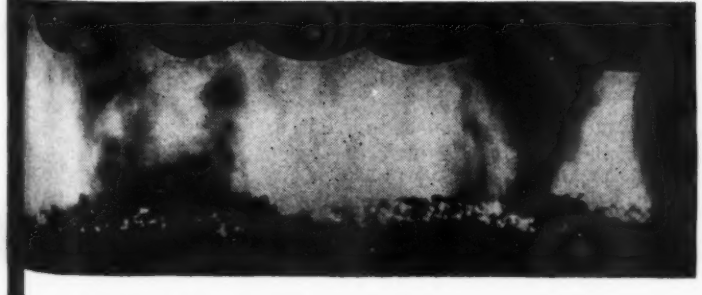
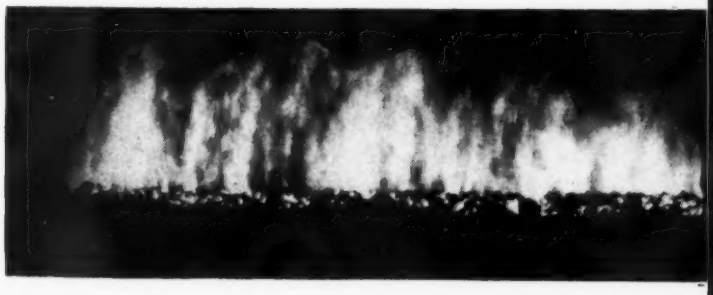


Fig. 2—After shots give solution: fuel bed uniformly thick; even flame density; a slight and even slag deposit





"before and after" of a coal-segregation problem. The shots of the fire show fuel-bed conditions on the tail end of the stoker. In the before picture (Fig. 1, lower,) notice that the fine-coal portions burn long and that much smoke is generated in that part of the fire. These streaks of fine coal indicate partial combustion, and explain the partly consumed coke in the ashpit.

In the center, and also along both sides where coarse coal segregates, notice that the flame is clear, indicating an excess of oxygen. Fuel-bed thickness also appears considerably less in these sections. This condition gives less protection for the grates.

The after picture (Fig. 2, lower) of the fuel bed shows the effects of a non-segregating type of coal feed. Fuel-bed thickness shows uniform from side to side and combustion also seems even. Flame density across the fuel bed appears substantially the same.

Ignition Arch. The two upper photographs portray the ignition arch. In the before picture (Fig. 1, upper) the inside surface of the arch has a slag accumulation that reflects an irregular combustion pattern. Compared with the before shot of the fuel bed this slag-deposit pattern can be seen to follow the irregularities of the fuel bed even to the extreme of almost stopping up some of the overfire air holes. The second picture (Fig. 2, upper,) shows a very small and evenly distributed slag deposit.

General Power-Plant Shots. Many good, helpful power-plant pictures may be obtained in an equally simple manner. A number of plants have enough daylight to give good results with time exposures of varying length. A watch with a second hand serves as a sufficiently accurate timer. It is well to point out that a record of exposure time allowed helps in making later comparisons with the resulting print.

If daylight is not available at the right spot, flash bulbs or photo floods act as supplementary or complete lighting. Drum internals can be pictured from the outside through the manhole by this method.

A good way to "highlight" machinery for a picture is to wipe it with an oily rag. One general, important rule: Clean up the subject.

One further comment—some experimenting is usually necessary. Since good photographers often make several shots of a given subject with different lighting and exposure time, a duffer should give himself just as wide a chance as possible to get a good print.

Boiler-Water Fouling Has Many Sources

All contaminating matter may not be visible to the eye. Preventive maintenance, says Harry M Spring, includes a study of sources, plus periodic tests for system leaks

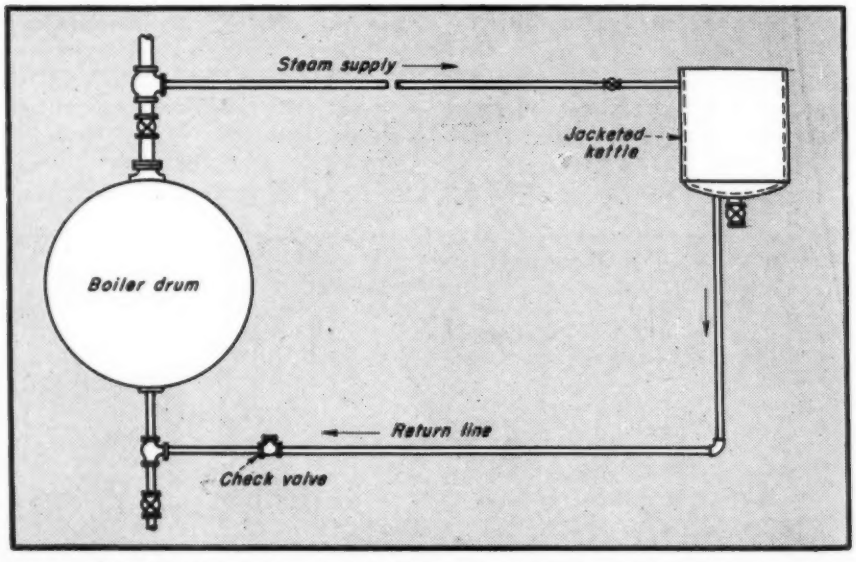


Fig. 1—Closing steam valve to jacketed vessel causes condensation in steam supply line; the resulting vacuum will draw in contamination from the vessel

► MANY SUBSTANCES, including oil, soap, grease, acid and various other chemicals, act as contaminating agents in boiler water. Some of these agents in fouling up the water give telltale indications of their presence. Others do not. No matter what its nature, fouling can lead directly or indirectly to damage.

Most readily noticeable of telltale signs in water contamination are foaming and discoloration. Such obvious danger signals call for quick action. If conditions appear drastic, shut down for inspection and cleaning.

Among those contaminating substances not apparent to the eye are acids and even insulating materials. Acid, of course, may silently destroy boiler metal until a failure reveals its presence. Insulating material that settles out on heating surfaces causes overheating and eventual damage to metal. Regular boiler-water chemical tests help show presence of acid as well as unusual contamination.

If fouling occurs the boiler must be purged, boiler and piping cleaned thoroughly. Investigations to track down the source of trouble should be carried out and corrective measures adopted.

A description of certain of these contaminating sources serves as a possible maintenance aid:

Soap Tanks. Soap in boiler water causes violent foaming; makes water-level determination virtually impossible. Low-water level often results, with subsequent overheating damage.

A defective steam-jacketed tank for heating a soap solution may prove a source of contamination. When the steam-supply valve, Fig. 2, to the jacket is closed, condensation may create a

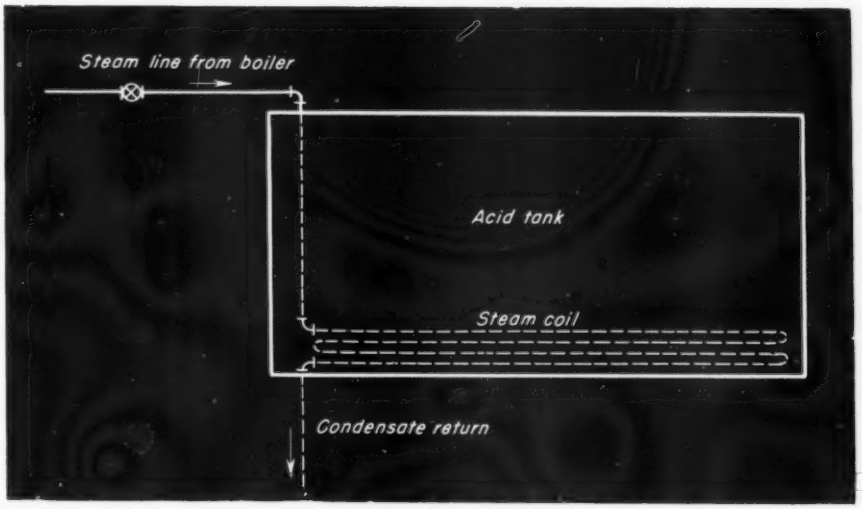


Fig. 2—The use of a steam coil for heating a solution in process carries possible contamination danger to the boiler water from leaks within coil members

vacuum that will draw soap from the defective vessel into the jacket. From there soap solution finds its way to the boiler through the condensate return lines. A good maintenance practice would be the occasional admission of steam to the jacket when the kettle is empty. This reveals even pinhole leaks.

Direct heating of a soap solution by immersing a steam hose opens the possibility of soap getting back into the boiler. If steam supply to this hose is controlled from the steam main, shutting off a steam valve at that point creates a vacuum in the hose line which may draw soap into the steam system.

Acid Tanks. Process heating of acid in jacketed vessels or in tanks heated by coils provides a means whereby acid may enter the boiler system. Condensing steam forms a vacuum, which pulls acid into the boiler circulation.

A steam test of dry coils locates any leaks. If coils are lead, their design may limit the temperature they can withstand. Should this temperature be below that developed by steam passing through the dry coils, a hydrostatic test must be substituted.

Oil-Condensate Return. Commonest source of oil in condensate is from reciprocating engines or steam-driven pumps. A dewaxed oil for cylinder lubrication, together with oil separators or filters, aids in controlling this problem.

Fuel-oil heaters occasionally develop leaks in the coils. If fuel-oil pressure runs higher than steam, in a burner designed to return heater condensate, fuel oil, in case of a leak, usually gets back into the boilers.

One remedy installs fuel-oil heater above the water line so that steam alone does the heating. Traps pass condensate to waste. A heat exchanger of simple design provides a good system for reclaiming heat in condensate, if that is desirable, without fear of contaminating the boiler. Some installations reclaim condensate itself. In these setups frequent tests for oil leaks must be made to insure trouble-free condensate.

Fuel-oil storage tanks equipped with submerged steam-heating coils carry the chance of leaks, through which oil may enter the system. Again frequent tests must be made for oil leaks.

Blowdown Tank. An attempt to retard corrosion with a slushing-oil preparation applied to internal surfaces of a blowdown tank led to contaminated boiler water. Plant practice called for opening boiler blowdown valve when a boiler coming off the line had dropped to 10-psi pressure. Apparently this practice resulted in a water seal forming in the blowdown tank when all the water was blown from the boiler. With no vent open on the boiler, a vacuum developed upon cooling and drew slushing oil up into the boiler itself.

Surface-Water Refuse. Makeup water, from rivers or streams, brings into the boiler plant the pollution introduced by upstream discharging of waste. Periodic tests are the only check on the extent of this pollution.

Economy Attempts. Fig. 3 illustrates an economy measure that opened the boiler-water cycle to contamination. In an effort to reclaim warm condensate from an exhaust drain, piping was connected to lead to the hotwell. Oil in the exhaust mixed with condensate and soon contaminated the boiler water.

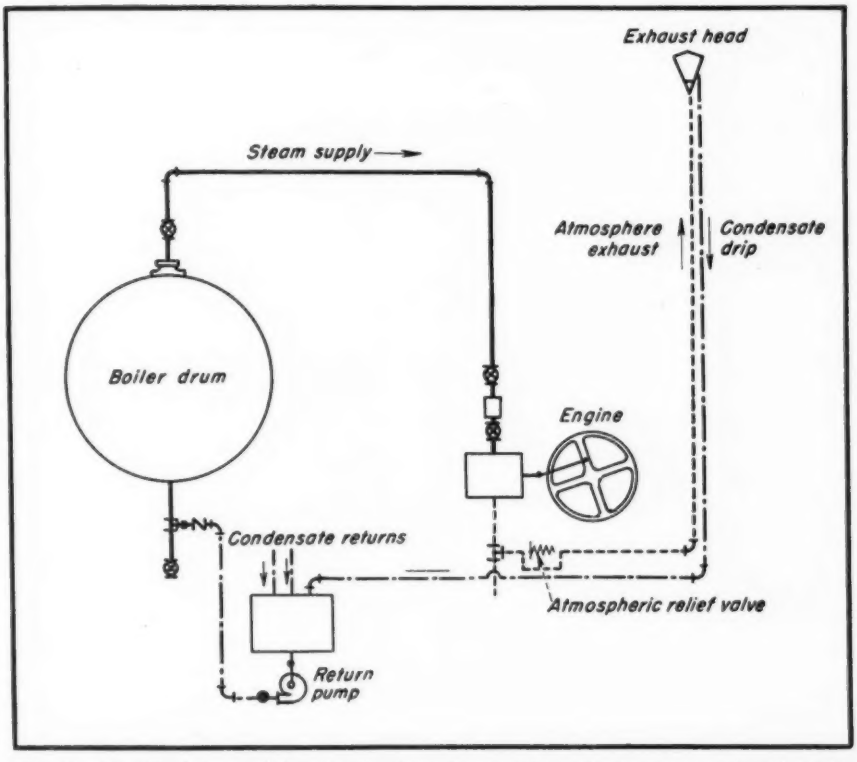
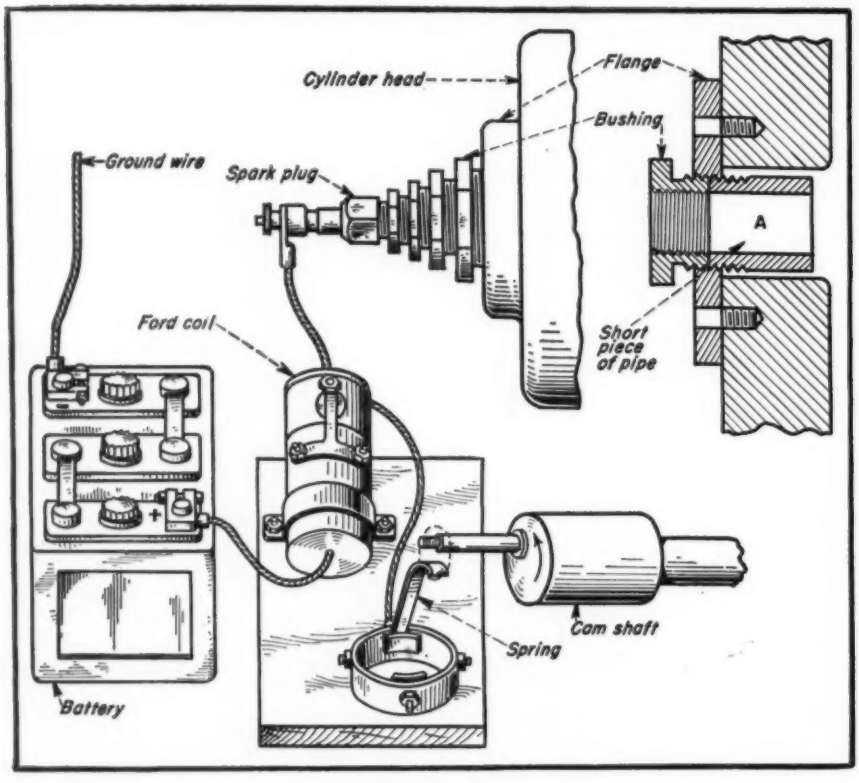


Fig. 3—An effort to reclaim the heat in the condensate from an exhaust drain by connecting piping directly to the hotwell introduced oil to the boiler cycle

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids to Operation



UNORTHODOX IGNITION KEEPS ENGINE GOING

ON A SINGLE-CYLINDER gasoline engine equipped with a make-and-break igniter, we converted to a jump-sharp ignition system when the magneto wore out and a new one could not be obtained. We removed the igniter from the cylinder head and over the opening placed a flanged pipe coupling, fastening it in position with the original studs. Center hole in the coupling was reduced with bushings to accommodate a spark plug, as in the diagram. On the inside of the coupling we screwed a short piece of pipe, as at *A*, to reduce the danger of blowing the gasket between the flange and cylinder head.

The igniter push rod was removed from the engine's crankpin on the camshaft. Below the crankpin we fastened a board after determining its correct position. A discarded Ford timer was then fastened to the board directly under the crankpin and a flexible piece of spring steel connected to one of its terminals. With the steel spring projecting upward a short-time contact is made with the crankpin on each revolution of the crankshaft.

A Ford spark coil was then mounted on the board and wired in the circuit, as in the diagram. The wire from the spark plug is soldered to lower terminal at the coil's edge and a wire from timer connects to the upper terminal at edge of coil. Another wire runs from coil's bottom terminal to the + terminal of a 6-v storage battery; we grounded the battery's — terminal to the engine frame.

Such an ignition system is easily timed by turning the engine until the marks on the timing gears match at the instant the crankpin contacts the spring. If timing marks cannot be found as a guide, turn engine until piston reaches point where firing should occur, then position timer so that crankpin contacts spring at that moment.

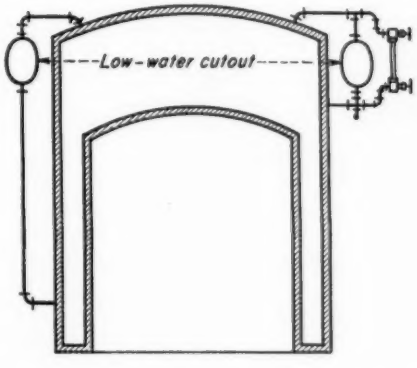
This kink shows how a little ingenuity prevented a long and costly delay even though the repair may not be permanent. This one kept the engine going in a pinch. It is still in service and probably will be for some time.

McCool, Miss. W B KENNEDY

Violent Boiling Causes False Low-Water Cutout

A LOW-PRESSURE BOILER could not raise sufficient steam pressure before the low-water cutout closed the fuel valve. Then the cutout would resume its normal position and light the fire again, with the water remaining at a safe level at all times.

We decided that violent boiling in



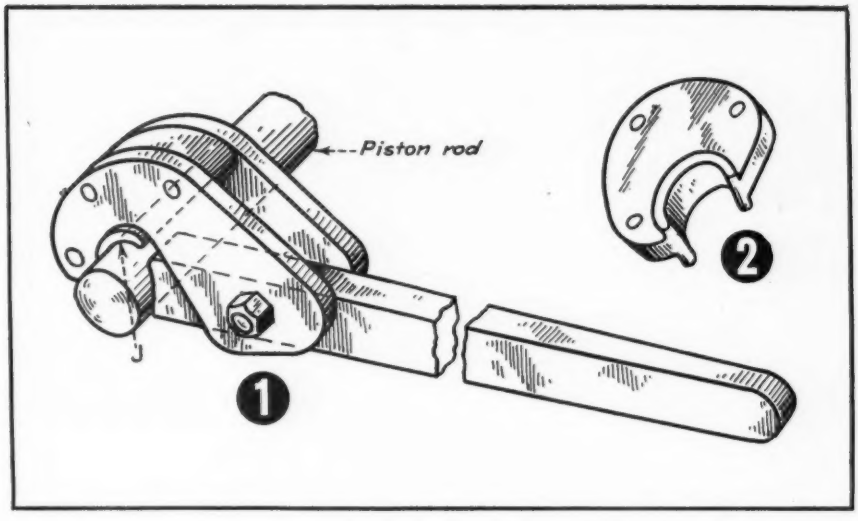
the boiler's narrow water legs caused rapid upward flow of the water. This drew the relatively cold water from the long vertical pipe connected to the cutout chamber on the left in the diagram. Loss of water in the pipe and steam pressure above the float caused the latter to drop to where the fuel was cut off.

To overcome this difficulty the low-water cutout was changed from the left-hand side of the boiler to the gage-glass connections on the right-hand side. Since making this change we have had no trouble from improper operation of the cutout.

EDWIN A KAUPAL

Del Paso Heights, Calif.

Non-Scar Wrench for Engine Piston Rods



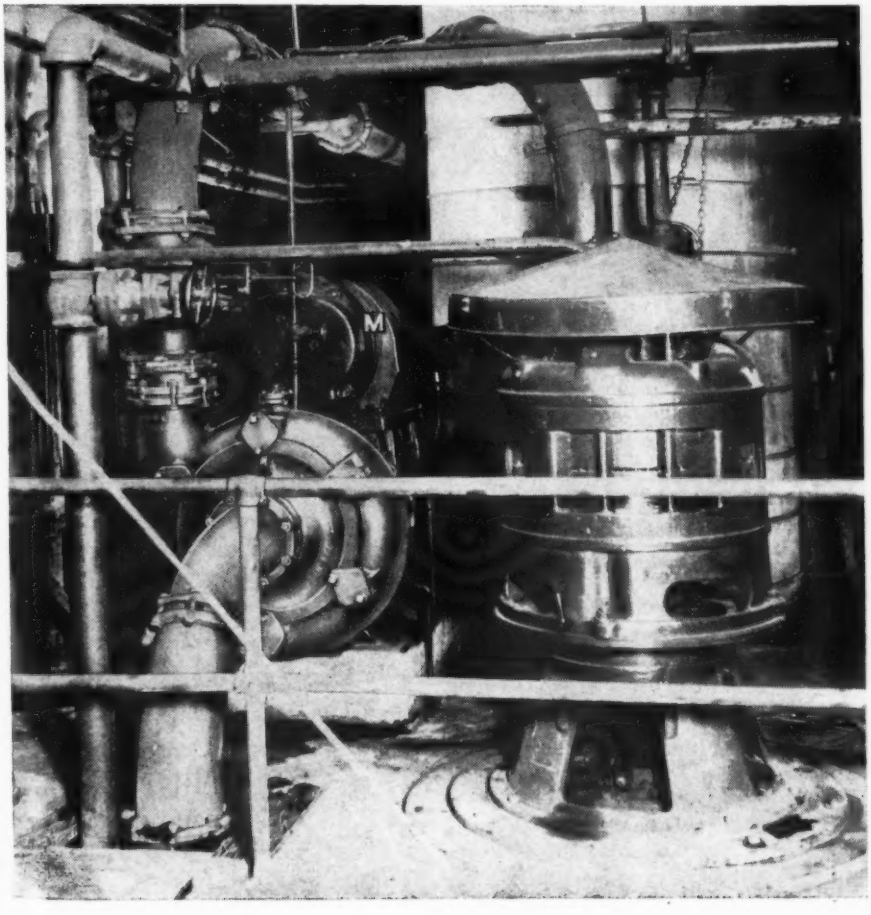
WHEN A PISTON ROD has to be removed from its crosshead, or its length adjusted to center the piston in its cylinder, some engineers do not hesitate to turn the rod with a stillson wrench. This is bad practice because it scars the rod, even if these scars are on a section outside the packing. To turn these rods in my engines I made wrenches like that in Fig. 1.

I made the sides of the wrench from pieces of $\frac{3}{8}$-in. steel, the handle from a piece of $\frac{3}{4}$x1$\frac{1}{2}$-in. steel and the wide-faced jaw *J* of brass. The latter, Fig. 2, was used so as not to scar the rod. A pin with a shoulder and thread for a nut connects the jaw to the handle so one swings freely on the other. When applied to the piston rod the wrench grips it with enough pressure to turn the rod under most conditions. The wrench is good for one size rod only, so if you have two sizes you need a wrench for each. But they are still worth the time it takes to make them.

Flushing, N. Y. S M ELONKA

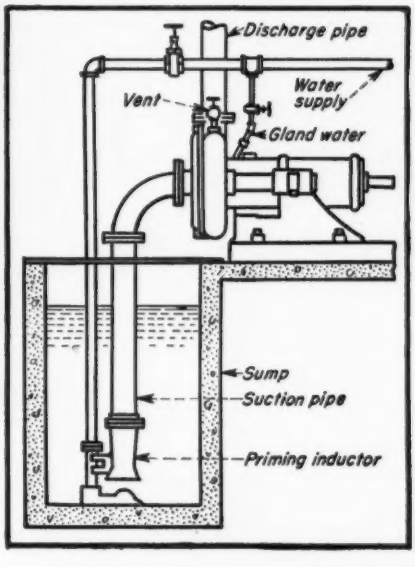
CHANGE IN PUMPS EXPEDITES ASH HANDLING

A MIDWEST POWER PLANT had trouble removing ashes from a sump with two vertical-shaft ash-handling pumps. Clinkers in the ashes, which the pumps could not remove, accumulated until they prevented the pumps operating. It was then necessary to drain the sump and have men clean it out. Some of the large clinkers carried out of the sump by the water stuck in the impeller, making it necessary to shut down the pump. Also the pumps needed frequent servicing, which was a repair-shop operation.



To improve operations and reduce maintenance costs, company engineers decided to replace one of the vertical-shaft units with a horizontal-shaft one, installed at floor level. Priming the pump offered a problem, solved by installation of a priming inductor on the suction lines intake end, see diagram. With this device, valves are not required in suction or discharge lines.

To insure handling the clinkers in

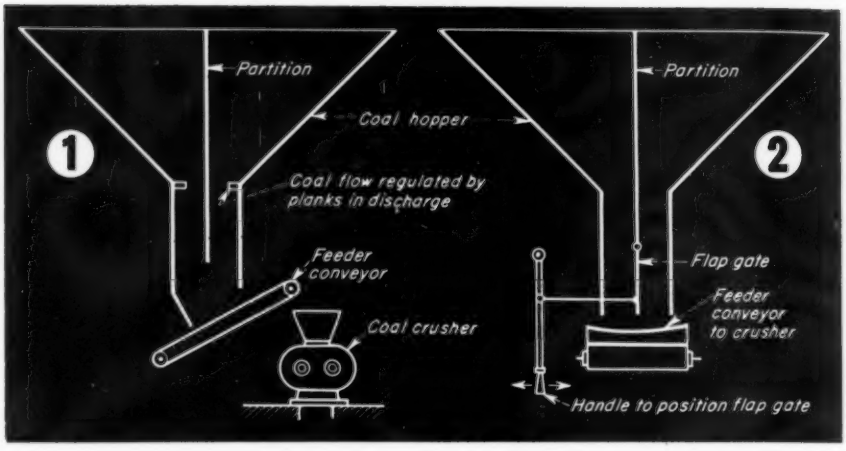


the ashes an 8-in. pump was selected, which is larger than the vertical ones. Also to reduce maintenance costs the pump selected was of slower speed than the old one. This had the advantage of increasing the size of the passages through the impeller, to handle larger clinkers.

Space was not available in which to install a direct-driven pump, so one was selected with the motor *M* installed on top of the pumps bearings, as in the photo. This motor is rated 50-hp at 1200 rpm and drives the pump through a 4-strand V-belt. This arrangement permitted use of a high-speed motor to drive a comparatively slow-speed pump.

The pump has been in service for 2½ years and has eliminated the troubles experienced with the vertical pumps. Chief factors are (1) equipment is large enough to handle easily the biggest clinkers coming into the sump and (2) pump operates at a slower speed than the vertical ones.

Chicago Heights, Ill. HARRY NAGLE
American Manganese Steel Division



FLAP GATE GIVES PROPER COAL MIX

A COMPANY THAT HAD A STOCK of coking coal could get a large amount of discarded free-burning slack, which could not be burned alone. By mixing two parts slack with one of coking coal a satisfactory stoker coal was obtained from two unsatisfactory ones. The coal-receiving hopper is divided into two sections by a vertical partition through its center, as in Fig. 1.

Slack coal is delivered to one side of the hopper and coking coal to the other. Coal flow from the two sides was controlled by planks in each outlet of the hopper. This arrangement never worked satisfactorily, was difficult to adjust, and the mix was not readily observed on the feeder conveyor because one coal was delivered on the other.

To get positive control of the coal and be able to observe the amount of each kind delivered to the feeder conveyor we turned the partition 90 deg in the hopper and installed an adjustable flap gate, as in Fig. 2. With this arrangement slack coal is delivered to one side of the conveyor and coking to the other. By adjusting the flap's position in the chute any desired coal mix can be obtained on the feeder conveyor. To compensate for increased friction on the coal in the chute, caused by the flap gate, we had to enlarge the opening on the chute's discharge side to load the conveyor fully.

Pueblo, Colo. C L CARTER

Clay Pipe Protects Underground Steam Lines

OFTEN A USE BOBS UP for an old and proved product that is even more startling than some new development. Such an adaptation is the use of clay channel pipe (sometimes referred to as half-round pipe) by the Birmingham Electric Co to inclose underground steam lines. As the photo shows, pipe provides a relatively simple and quick installation, and furnishes protection to the steam line.

Installation is made by laying a slab of concrete, about 5 in. thick, on the trench's bottom. This forms a cradle or support for the insulated steam pipe so that it can expand and contract freely, and be easily available for inspection or repairs, if necessary. Conventional hollow tile are laid on top of the concrete slab on either side of the steam pipe to support the clay-pipe roof. Channel pipe is then laid on top of the tile to form a clear, unobstructed tunnel below (see photo). Bell and spigot ends of the channel pipe are jointed with hot-poured jointing compound. The channel pipe is also grouted firmly into the tile with mortar to provide a watertight seal.

This clay channel-pipe tunnel protects against the earth's dampness and keeps the steam-pipe insulation dry.

The Birmingham Electric Co formerly used metal culvert for these installations, but turned to clay channel pipe because of metal shortages during the war. Since initiating this practice, it has built several clay-pipe tunnels.

Ice Serves as Lowering Tackle

FROST CAN BE USEFUL at times. Here's how it did a difficult construction job under arctic conditions with the temperature down near the bottom of the thermometer. On the bank of a Russian river a casting that weighed several tons had to be lowered into a foundation hole without suitable tackle. Jacks could not be used because of close clearance between the concrete pit's sides and the casting's base. Whatever went under the casting had to flow out, which suggested the use of ice.

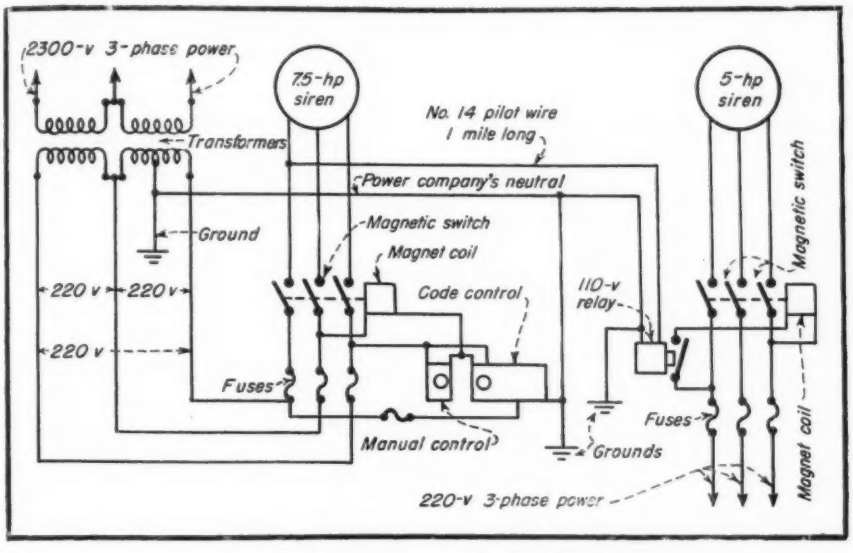
There was plenty of ice on the river

and lake, but it was uneven and lumpy. The casting had to be lowered onto its foundation bolts with little or no adjustment to position. As an aid, we welded an extension rod to each foundation bolt. These rods were of smaller diameter than the bolts and long enough to reach several inches above ground level. A wooden template with properly spaced holes was then placed over the extended bolts and held in correct position by pegs driven in the ground.

We then put closely packed broken ice, a foot deep, in the bottom of the foundation hole, ran in sufficient water to fill the voids and let the mixture freeze. Layer after layer was added and frozen until the foundation hole was filled with a solid block of ice, which held the bolts in place.

After removing the template, the casting was jacked into position for the foundation-bolt holes, and lowered on the ice. We built a shelter over the casting and its foundation. With a slow wood fire in the hollow of the casting we melted the ice and pumped out the water, until the casting settled gently onto its foundation.

Brighouse, England F L Berry



RELAY CUTS COST OF INSTALLING SIREN

The signal system in the diagram is not in a power plant, but the idea has application wherever two sirens or gongs are a considerable distance apart and operated from a single station. Our town grew rapidly and some of the firemen live a long way from the city hall, where the fire station is located. The fire chief wanted a siren installed about a mile from this station where one was already located, the two to be sounded by the same signal on the system.

To the new siren we ran one wire on the power company's poles and used their grounded neutral as the return, see diagram. To actuate the siren we installed near it a 110-v relay from an old electric range. One terminal of this relay connects through the ungrounded wire direct to one leg of the siren at the fire station. We connected the other terminal of the relays through the power company's grounded neutral to the center tap on one of the 2300 to 220-v open-delta connected transformers in the station.

These connections permitted manual operation of both sirens from a push-button at noon, or from the code switch for fires. The new siren takes power through a magnetic contactor from a nearby 220-v 3-phase power source that supplies a pumping station. When the relay is actuated from the fire station it completes the circuit to close the siren's contactor.

What looked like an expensive job worked out to be low in cost, the main expense being one mile of No. 14 weatherproof wire. Residents in the area near the siren are not enthusiastic, but the fire chief now has more men to help him and that's what counts when fighting fires.

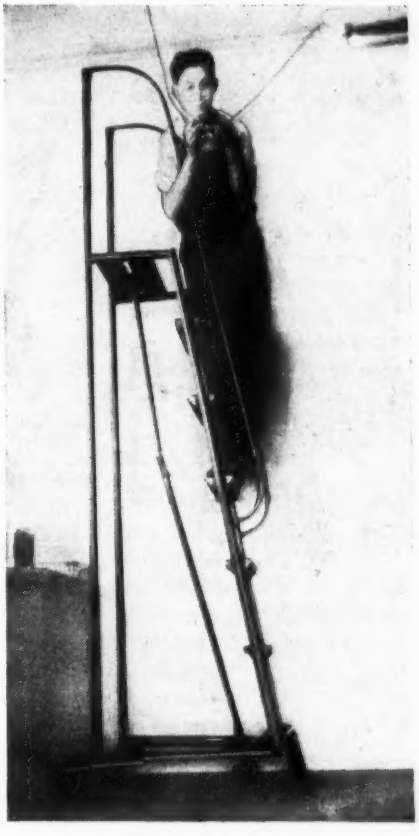
Carlsbad, N. M. E A Roberts

Safety Ladder Made by Welding

The photo shows a really safe ladder that has eliminated accidents caused by falls from old wooden ladders, says August F Dohert of Tennessee. Besides using ladders of this design for maintenance work the girls use them in the shipping department to store merchandise in high places.

These ladders are made of steel tubing and plates arc-welded together. They were easy to cut and weld, without jigs or special equipment except our arc-welder. Fixed castors are provided under the two back legs with an adjustable swivel castor under the front legs. The adjustable castor is so arranged that by pulling a handle in the middle of the ladder its front legs can be lowered to or raised off the floor.

When in use the front castor is raised, so the legs rest firmly on the floor to hold the ladder steady. When it is moved from one place to another the swivel castor is lowered to lift the front



legs off the floor. The ladder is then free to be moved to a new location on the three castors.

Two side hand rails provide additional safety. Welding the steps and top platform eliminated the necessity for cross-bracing so that the workmen's hands can slide along the rails full length without having to let go to clear obstructions.

Troy, Ohio R G Swisher
Hobart Bros

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

1—What Is Advantage of Each Boiler-Patch Shape?

I HAVE SEEN round, oval and diamond boiler patches and wonder why the different shapes are specified. On various occasions I have discussed this subject with other engineers but still haven't found the answer. I would like to know once and for all what the advantages are of each shape.

If POWER readers know why the different shapes are specified will they explain where to use each kind and show how to apply it. A sketch showing actual installation with rivets will be helpful because the patches I've seen are all different.—*FWO*

2—Will Generator and Motor Start Together?

OUR POWER PLANT has a 750-kw 440-v 200-rpm engine-driven generator and a 1000-kva 2300-v 3600-rpm turbine-generator set, both connected to the same system through transformers. I want to run the 1000-kva generator independently of its turbine as a synchronous motor to check vibration. We tried starting it as an induction motor from the smaller engine generator, but it was no-go. The smaller generator just died every time we closed the circuit.

Someone suggested connecting the two machines electrically and starting them simultaneously. I would like to know whether this can be done, and if so how you go about it. Every time we tried it the engine generator started with a jerk and the circuit breaker jumped out.—*ALD*

Answers to March Questions

Are Blowdown Valves In the Right Spot?

(This is Question 1 from the March issue, with best answers from readers)

We have a blowdown valve-and-pipe arrangement that should be corrected. Before laying out changes in our boiler room, which is over 40 years old, I want to be sure they are justified. The room, which has two 750-sq-ft hrt boilers, is 16 ft below ground level. It is a hot hole, and cramped for space. The layout for the piping is shown in sketch Q-1 (*March* POWER).

Some of the men use one sequence, and others use a different one for blowing the boiler. The only idea common to all is to do the job and get out of the hot cramped space behind the boilers as fast as possible. One method is to open the two blowdown valves first, and then open the quick-opening valves one after another. They guess at the amount of blowdown, then kick the quick-opening valves shut and close the blowdown valves.

It seems to me that each boiler should have two valves in the connecting line ahead of the blowdown line. Shouldn't valve D on No. 2 boiler be somewhere in the line running from the boiler instead of in the location shown? Assuming the hookup indicated is maintained, what is correct sequence of valve opening, starting with No. 2 boiler? If POWER *readers can suggest better arrangements or good ways to handle our present system, we would like to try them.—WJH*

Regulate Boiler Blowdown

ALTHOUGH THE ASME CODE allows one blowoff valve for boilers under 100 psi it is far safer to have two as in sketch 1-*A*. In any case, only one quick-acting valve next to the boiler should not be tolerated.

The blowoff tank should be lowered to allow connection from the boilers to be made at the top. Lines should pitch towards the tank.

By taking out existing valves *D* and *B* and placing them next to the quick-acting valves already in the line, there will be an orthodox setup conforming to the Code.

Always open quick-acting valves first. Impress on operators that this must be no slapdash action. Next, open the globe valve. When shutting off the blowoff the globe valve should be closed first, then the quick-acting valve.

WJH mentions that amount of blowoff is guessed at, but this can be regulated by specifying so much time.

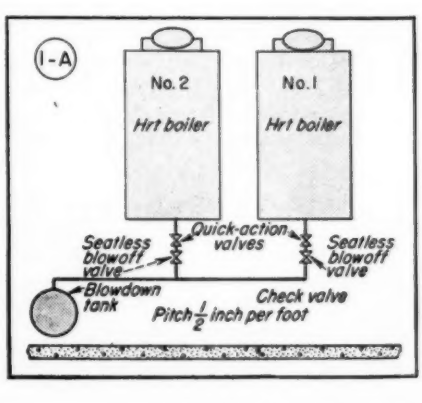
Dolbeau, Que. R A LANE

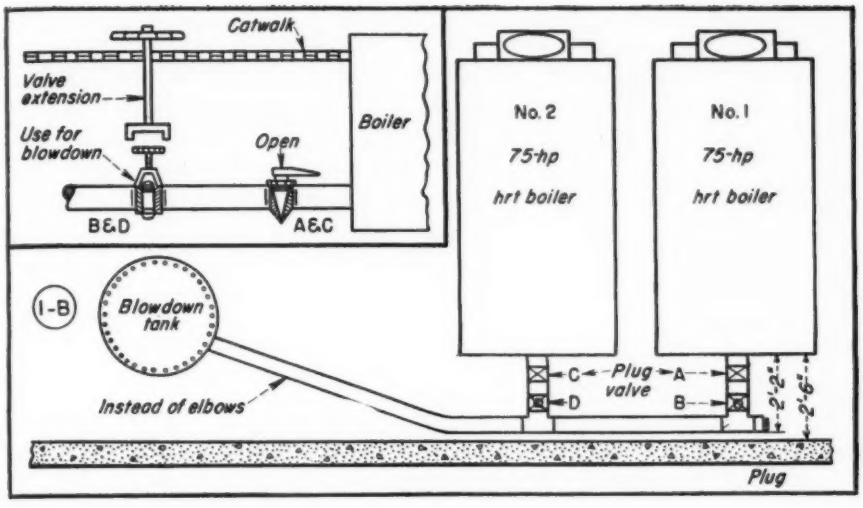
Relocate Valves

I BELIEVE WJH has the right idea about changing blowdown valves. Boilers No. 1 and 2 should each have two valves between them and line running to blowdown tank.

On system as now laid out if valve *C* on No. 2 boiler stuck or failed in an open position, No. 1 boiler could not be blown down. Also, boiler pressure is being carried on more pipe and joints than would be necessary if change were made.

Kenmore, N.Y. R E FOUNTAINE





Put Handles on Valves

BLOWDOWN VALVES should be as close as possible to boiler. The two valves should be about 6 in. apart. Plug cock comes next to boiler, and then the blowdown valve. This removes danger of waterhammer in main blowdown line.

Blowdown valves and valves *D* and *B* should be used only when blowing down the boilers. It is not necessary to get down into the "hot hole," because valves can be easily fitted with handwheel extensions, as in sketch 1-*B*. Then men operate them from the ground level, with a catwalk or platform over the hole to stand on, as insert shows. We have valves with extensions over 10 ft that are operated without trouble.

Soo, Ont. A J SMITH

Don't Kick Valves

WJH WILL FIND it is dangerous to throw a quick-opening valve open or shut suddenly. Resulting waterhammer may cause a pipe or joint failure. For efficient operation blow down only one boiler at a time. Best sequence for blowing on a deadend line is to blow down boiler farthest from tank or at deadend, thus warming up the entire piping and reducing stress and waterhammer to a minimum. Then blow each boiler in turn towards tank.

Montreal, Que. ARTHUR BELTON

Install Two Valves

WJH's BOILERS should have two valves on the connecting line as close to the boiler as possible. The quick-opening valve or cock should be connected close to the boiler and the slow-opening valve in back as in sketch 1-*C*.

Boiler operators are also assured better protection by use of two valves. These valves are an important accessory and require daily checking for leakage and operating ease.

First, open quick-opening valve *A*, then slow-opening valve *B*. For cutoff close slow-opening valve *B*, then quick-opening valve *A*. After *A* is closed open slow-opening valve *B* to release water trapped between two valves; then close it.

Baltimore, Md. C D PRICE

Two Valves Per Boiler

ASSUMING THAT the working pressure of these boilers exceeds 100 psi, I agree that the individual blowdown leads should have two valves. Both valves could be slow-opening, or one slow-opening and one quick-opening. *WJH* may use his existing valves by placing *A-B* and *C-D* in tandem on the individual lines. Locate the quick-opening valves next to the blowdown main. Sequence of blowdown operation should be: Open the quick-opening valve first and close it last. *WJH* should connect the individual blowdown lines to the main line through long bends.

Guessing at the amount of blowdown should not be tolerated. If the approximate quantity under different pressures against time of opening cannot be established, *WJH* should install an extension to water column, or through a series of mirrors transfer the boiler-water level reading to a point where the operator may observe it. Through extension of the valve rods or spindles of the blowdown valves, point of control could be brought in line with the passage between boilers, which should prove advantageous considering the transfer of water level and the limited space for operation at rear of boilers.

Detroit, Mich. A G J

Boiler Operation Is The Real Problem

THE VALVE next to the blowdown tank should be on the line from No. 2 boiler, next to the quick-opening valve. Then if boiler 2 is out of service only two valves have to be operated to blowdown boiler 1. Also, men working in No. 2 have more protection from the blowdown line.

WJH has more to think about in boiler operation than in piping setup. Any man who blows down a boiler in the way he describes should be fired on the spot. Why does he think the Code calls for a slow-opening valve on the blowdown line? Quick-opening valves should always be opened first and closed last.

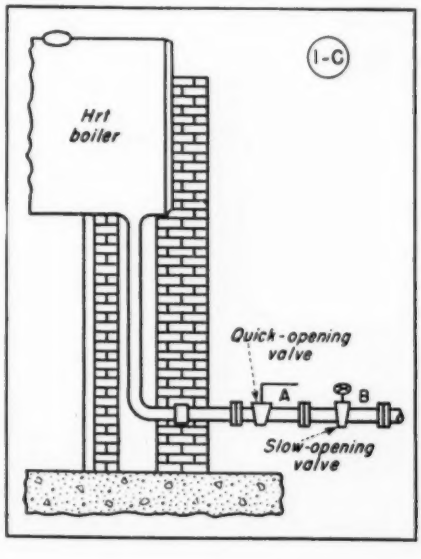
Beverly, Mass. R B GOLDSMITH

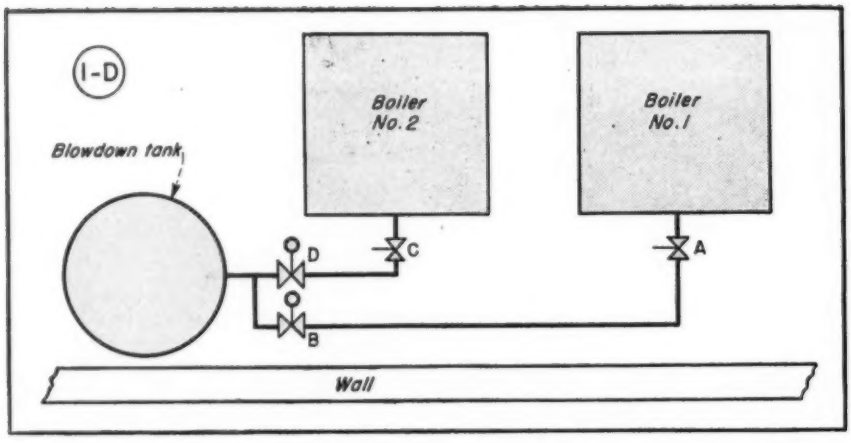
Cool Boiler Room

FAULT OF HOOKUP, as I see it, is that the boilers are below street level, and it is hot and cramped where men are blowing down.

The boiler Code states that valves as in sketch (March POWER) will be correct if the following is carried out: On a boiler having a number of blowoff pipes a single master valve may be placed on the common blowoff pipe from the boiler and only one valve at each individual blowoff connection. The quick-opening valve or cock, if used, should be placed next to the boiler.

I believe *WJH* could make conditions better by cooling the room, even if it





meant installing a few windows or ducts to circulate some outside air. This would reduce the boiler-room temperature, even if he cooled air only during blowdown.

Philadelphia, Pa. W T MULLEN

Valves Installed Right

ACCORDING TO ASME CODE quick-opening valves should be placed near the boiler. Quick-opening cocks are permissible on installations operating at 100 psi or less. A regular blowoff valve is also used with the quick-opening cock. With higher pressures, use two regular blowoff valves designed for the specified pressure.

Valve nearest the boiler should be opened first and closed last. This is done to concentrate wear on the valve that can be repaired without shutting boiler down.

I don't agree with method used in operating the valves. Blowoff valves should be opened and closed with a certain amount of caution; kicking one shut may rupture the blowoff line, especially on an old installation.

So. Vineland, N. J. T DE ROSA

Two Valves Are Safest

WJH IS CORRECT in suspecting that one valve is badly placed. With the present setup, to drain boiler No. 1, three valves must be opened. This leaves only one to keep water in boiler No. 2. This last, being a quick-action valve, is bound to have considerable leakage. An even worse condition—with considerable danger to personnel—would occur if boiler No. 2 were laid up. In such a case, one leaky valve is all that keeps any one working inside boiler No. 2 from getting a bad scalding. I am sure no inspector would approve such a setup.

A suggested layout is given in sketch 1-*D*. Blowdown practices vary, but a sudden release of water from the boiler, and consequent inrush into the blowdown line and tank, is never desirable. Best practice is to open the quick-acting valve first, then slowly open and close the blowdown valve, after which the quick-acting valve is closed again. Only function of the latter is to prevent water rushing out of the boiler should the blowdown valve fail to close.

Paterson, N. J. F M GIORDANO

Open Slow Valve Last

BLOWDOWN ARRANGEMENT SHOWN is not correct. Locating valves *B* and *D* as shown on the sketch (March POWER) causes full boiler pressure to be carried on almost all of the exposed blowdown line unless valves *A* and *C* are perfectly tight. Both valves should be together ahead of blowdown line.

In operation the cock or quick-operating valve is opened first, and slow-operating valve opened gradually until full opening is attained. When the proper amount of blowdown is bled from the boiler close slow-operating valve tightly; then close cock or quick-operating valve. Operating quick-opening valve or cock in this manner means that it is always opened and closed at no flow; as no cutting effect takes place, it will remain tight indefinitely. This operating method also prevents undue shocks and strains on piping.

Duluth, Minn. E R WEBBER

Control Valves From Front

IF WJH WILL ATTACH extension rods to the valves, the blowdown can be controlled from the front. The operator is then in the open where he can see the gage glasses and blow down the required amount in comfort.

Valves of sketch 1-*E* would be operated as follows: Open both *C* and *A*. Open *D* and blow down the required amount. Open *B*, blow down, then close. Close *C* and *A*.

Sarnia, Ont. L B KILBREATH

Eliminate One Valve

THE QUICK-OPENING VALVES *A* and *C* next to the boilers should be opened first and closed last. A plate to this effect should be placed on the handwheels of these valves.

According to the Code, it is permissible to have one master valve, which must be slow-opening only if one boiler has more than one blowoff line.

For best results valves should be placed as close as possible to the boilers and the boilers should never be blown down with valves partly open.

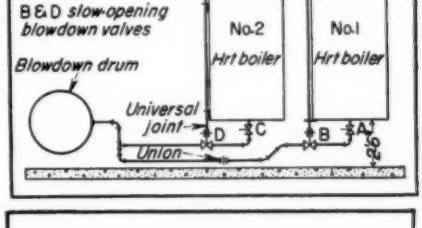
Akron, Ohio D D SMITH

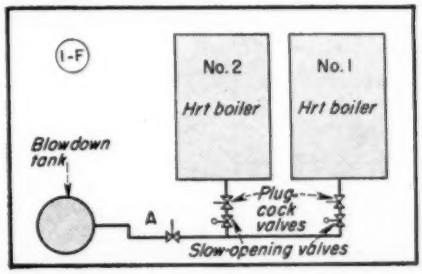
Open Quick Valve First

THE PROPER PROCEDURE for blowdown valve operation is to open quick-opening valve first, then blowdown valve. Blowdown valve should be closed off first, quick-opening valve last. This avoids violent shocks that are produced by the valves. Each boiler must be blown down separately. Amount of blowdown should be 10 sec, no more, no less. To blow more than 10 sec wastes fuel. If boiler needs more blowdown, the operation should be done oftener.

Blowdown piping can be changed as in sketch 1-*G* for convenience.

Oaklyn, N. J. C A WILKS





Try One Blowdown Valve

TO BLOWDOWN BOILER *WJH* should open plug cock on one boiler and then the slow-opening valve. At end of blowdown period the slow-opening valve is closed first, then the plug cock.

A slow-opening valve may be placed in line at *A*, sketch 1-*F*. Blowdown sequence after opening *A* would be the same: First open the cocks, then the slow-opening valve; close slow-opening valve first, then the plug cock.

East Weymouth, Mass. J J DALEY

Layout Violates Code

WJH'S BLOWDOWN SYSTEM is not according to Code, which specifies that two valves shall be installed in the line leading from boiler to blowdown header. It reads: "P-311 (a) On all boilers, except those used for traction and/or portable purposes, when the pressure exceeds 100 psi, each bottom blowoff pipe shall have two slow-opening valves or one slow-opening valve and one quick-opening valve or a cock complying with the requirements of Par. P-310."

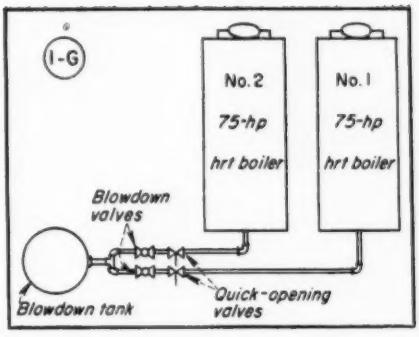
Even if pressure is below 100 psi and the law allows only one valve, it is always good practice to have two. This assures against leakage and breakage of one valve. The quick-opening valve should be next to the boiler with a slow-opening valve next in line.

An easy way to keep men from having to go behind the hot boiler to blow down is to install reach rods from the valves to side of boiler.

Baltimore, Md. C W PARKS

Rearrange the Valves

ASSUMING THAT OPERATION is at 100 psi or above, the blowdown piping on *WJH's* boilers should have two valves, or a valve and cock in the connecting line from each boiler ahead of the blowdown line. This is in accordance



with ASME Boiler Code. Inasmuch as there is a space of only 2½ ft from boilers to wall it will be necessary to run the connecting lines on a 45-deg into the blowdown line. Correct installation will give full protection and control.

Mundelein, Ill. R D MINEHART

EDITOR'S NOTE: *WJH's* valve problem brought so many replies that the remainder will appear in June POWER.

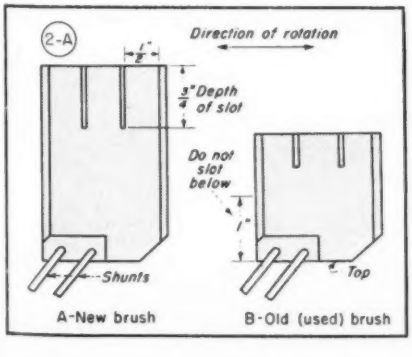
Why Do Brushes Squeal on Starting?

(This is Question 2 from the March issue, with best answers from readers)

In our power substation we have a 30-cycle 400-kw rotary converter. The machine has a 625-v dc output. When we bring this unit up to speed the brushes on the sliprings start squealing. They continue to squeal until the machine is synchronized. The converter is started and brought up to speed with a separate 3-phase induction motor mounted on the end of the shaft. There appears to be no vibration or other visible reason for the brushes squealing.

During operation the converter operates quietly except under heavy overload when the brushes start squealing again. The brushes are in good condition and so far have not given any trouble. The rings are copper and brushes a medium-soft carbon.

We would like to stop the squealing as it is annoying and we never know when trouble might start. Can POWER *readers suggest a possible remedy for our trouble and give us some idea what is causing the noise during starting and overload?—CLC*



Slot the Brushes

CLC'S TROUBLE is caused by a combination of too high spring tension, too low average current density of the brushes, too high brush coefficient of friction, atmospheric conditions, and brushes that do not form a film on the rings. When the machine starts the brushes squeal. The friction is too high. This condition is associated with mechanical operation and wear.

Then, when the machine is synchronized there are both mechanical and electrical operation and wear, and the passage of current through the brushes to the rings causes the oxide film on the rings to break down. Consequently, the brushes stop squealing.

When the machine picks up overload, however, brushes start squealing because their average current density is too low and their friction coefficient too high. With the brushes carrying the high overload currents, their temperature increases. The inherent coefficient of friction increases with the temperature to such a value as to result in squealing.

I suggest that *CLC* reduce the spring tension, that is, lower the brush pressure. It should not be reduced below 1½ lb per sq in.

To eliminate squealing under overload conditions slot the brushes as in sketch 2-*A*. Slotting gives them more contact to the ring surface since less gas pressure is formed.

Tenafly, N. J. K B HOFFMAN

Check Brushes and Rings

IF THE BRUSH HOLDERS of *CLC's* machine are reaction type, shaft angle and direction of rotation are important. I suggest he check brush pressure, grade of carbon, rough spots, possible looseness in holder, high or flat spots on rings, brush-carrying capacity, and ratio of brush area to ring surface. In regard to squealing at the overload, it is quite possible that the rotary converter is operating inverted, hence a speed increase and squealing.

CARL BACHMANN

Astoria, L. I., N. Y.

Try Graphite Brushes

IN REGARD TO THE BRUSHES squealing I suggest *CLC* check for any cutting or

(*Continued on page* 148)

RECIPROCATING-PUMP Q&A FOR POWER ENGINEERS

By E F WRIGHT

9—Rod, Piston and Plunger Packing

In the ninth of a series, E F Wright, chief engineer, reciprocating pump division, Worthington, selects questions and answers that give practical understanding of construction, operation, characteristics, troubles and remedies.

Q 1—What is pump packing?

A—It is any material used to control leakage between a moving and a stationary pump part, such as piston rod and cylinder head, or piston and cylinder liner. Packing is (1) expendable, thus reducing wear on more costly parts (2) flexible to conform to shape of adjacent parts, and (3) usually relatively soft. With the exception of piston packing, most packing is installed to permit adjustment for the best balance between leakage and wear of both packing and parts in contact with it.

Q 2—What materials are used for pump packings?

A—Packing may be anything from a strip of leather to a cast-iron snap ring. Flax, braided and impregnated with tallow, and braided asbestos, impregnated with graphite and oil, are common materials for rod and plunger packing. Layers of cotton duck bonded with rubber are commonly used for piston packing for cold water, and special compounds of the same type are used for hot boiler-feed water. Canvas, impregnated and bonded with bakelite and sometimes graphitized, is used in the same way. Soft metals, such as lead, babbitt, aluminum and copper, are used in shredded form, for instance (1) foil wrapped or crumpled around a softer core, together with suitable lubricants, or (2) segmental rings of solid metal, flexibly supported in contact with rod or plunger. While many different materials may be used, satisfactory performance requires proper selection, installation and care.

Q 3—What is the most important element in good packing performance?

A—It is the care with which packing is handled, installed and adjusted. Relatively poor and inexpensive packing may give excellent service if properly handled, while carelessness may quickly spoil the best material. Cleanliness, a first consideration, applies to both the stuffing box and any surface used in cutting or forming the packing. A little grit on a new packing ring may seriously damage a rod or cylinder liner. Second, packing must be properly fitted with allowance for expansion under existing conditions. This applies to both initial fitting and running adjustment. Some leakage is needed for lubrication and cooling. An overly tight packing runs hot.

Q 4—What are the essential parts of a piston rod stuffing box?

A—Fig. 1 shows a simple piston-rod stuffing box, consisting of a cavity to receive the packing, a close fit around the rod at *A* to prevent packing extruding into the cylinder, and an adjustable gland to close outer end of box. On small rods a single nut sur-

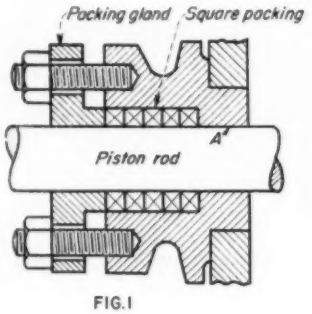


FIG. 1

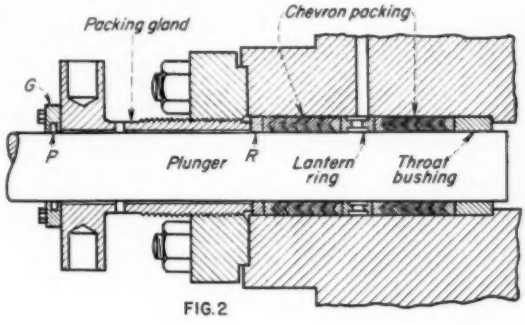


FIG. 2

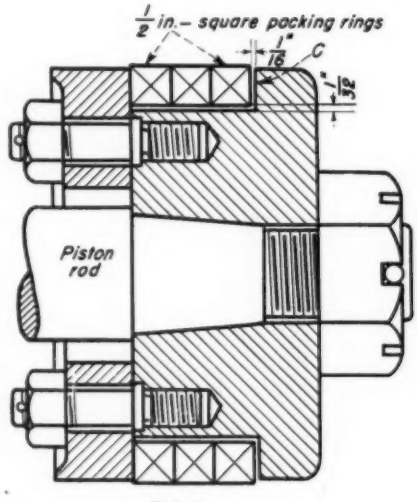


FIG. 3

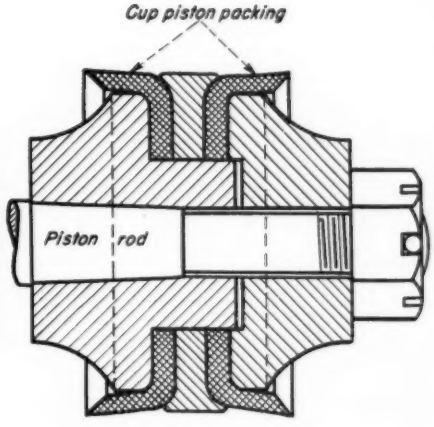
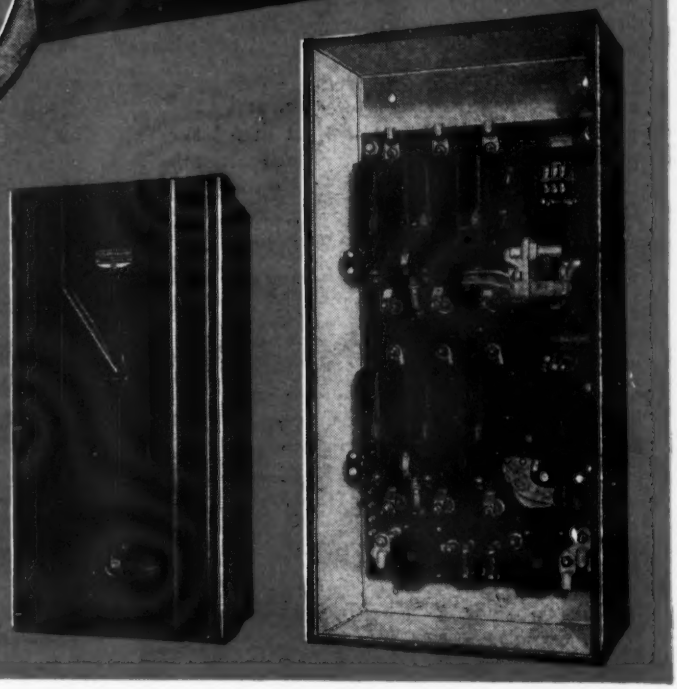


FIG. 4

Fig. 1—This simple piston-rod stuffing box contains square flexible packing. Fig. 2—Stuffing box and chevron packing that is used on the plunger of high-pressure hydraulic pump. Fig. 3—Pump piston packed with three rings of soft, fibrous packing. Fig. 4—Self-sealing cup packing on a double-acting piston

Cutler-Hammer Combination Starters



Cutler-Hammer Combination Starters offer many advantages that production-minded executives and experienced electrical supervisors are quick to recognize. Combining motor control *and* safety switch in one compact case, they save just about half the time required for mounting and wiring separate units. They effect savings throughout their long life by providing greater convenience in operation and maintenance. They protect motors against overload but, through use of the famous Cutler-Hammer Eutectic Alloy Overload Relay, they do not needlessly interrupt production on harmless current surges. They provide the smooth trouble-free performance of Cutler-Hammer Dust-safe Vertical Contact motor control and a motor-circuit switch built to the same high standard of engineering excellence. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee 1, Wisconsin. Associate: Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

CUTLER-HAMMER
MOTOR CONTROL
C-H

Look for these superiorities in C-H Combination Starters

Eutectic Alloy Overload Relay
This famous engineering achievement utilizes a fusible alloy with unvarying characteristics. Grips tight till the danger point is reached, then releases instantly to cut motor off the line. Resets without delay.

Dust-safe Vertical Contacts
Assure full metal-to-metal contacts. No arcing, burning, pitting or welding. No dressing or filing.

Trouble-free Safety Switch
The motor-circuit switch in a Cutler-Hammer Combination Starter is built to the same high standard of engineering excellence as the motor control.

Plenty More Features

- General purpose and NEMA types 1A, 4, 5, 7, and 9 special service enclosures.
- Heavy-duty contactors, open and accessible. Pivoted construction and self-aligning armature eliminate sliding friction, assure positive, equalized contact pressure and quiet operation.
- Magnet coils, vacuum-impregnated, solid 100% filled. Easily accessible.
- Disconnects; side-operated safety switch; front-operated contactor type or thermal type circuit breaker.
- Low voltage control circuit from self-contained transformer.
- Vise-type main circuit fuse clips.
- Reversing or non-reversing.
- Cadmium plating or stainless steel metal parts protect against rust.

PUMP Q&A

Continued

rounding the gland is often used instead of studs. Most stuffing boxes are fitted with a replaceable bushing, usually of bronze, at the stuffing-box base.

Q 5—What type of stuffing box is used for the plunger of high-pressure hydraulic pumps?

A—Fig. 2 shows such a box. The gland threads into a heavy flange, which is centered by a counterbore in the cylinder and bolted solidly in place. A separate metal-packing ring *R*, closely fitting the plunger and stuffing-box bore, is used between gland and packing. This construction provides ample clearance between gland and plunger, and permits ready adjustment without danger of scoring the plunger by unequal tightening of two or more gland nuts. Gland and flange are removed as a unit when repacking the stuffing box.

Q 6—What is a lantern ring or gland?

A—The relieved metal ring at center of packing space, Fig. 2, is known as a lantern ring or gland. Holes through its center section permit free circulation of fluid or lubricant around the plunger and to the packing on either side of ring. On vacuum pumps this ring permits use of sealing fluid to prevent entry of air. On high-pressure pumps it distributes grease to packing around the plunger.

Q 7—What is a wiper gland?

A—The main gland, Fig. 2, has a light auxiliary gland *G* with a small packing space *P* to control leakage flow from the high-pressure packing. The wiper keeps the high-pressure packing leakage from traveling along the plunger and dripping on the crosshead guide. Auxiliary glands are used also when it is necessary to inject water or oil to absorb and dispose of leakage of volatile or inflammable fluids, such as light hydrocarbons.

Q 8—What are the major differences between a piston packing and a rod or plunger packing?

A—Fig. 3 shows a simple piston with soft, fibrous packing. Clearance *C* between packing and packing space permits fluid pressure to act on one end and the inside of the packing to hold it against and seal the other end of the space and the cylinder bore. No adjustment is possible when the pump operates nor is it required since all wear takes place on the packing's outside face. In a rod or plunger stuffing box the adjustable gland cannot seal the outer end of the stuffing-box bore; hence the packing must fill the space and seal along both its inner and outer surfaces. While some packings when first installed may move in the stuffing box to maintain contact with the gland, it is usually necessary to compensate for packing wear by tightening the gland to press the packing against rod or plunger.

Q 9—How does a relatively soft, fibrous packing seal a pump's fluid piston?

A—As mentioned in Q 8, fluid pressure on one end and on inside of the packing holds the other end in contact with the piston, and the outside in contact with the cylinder bore. This pressure also holds individual rings in sealing contact with each other, and there is a sharp drop in fluid pressure

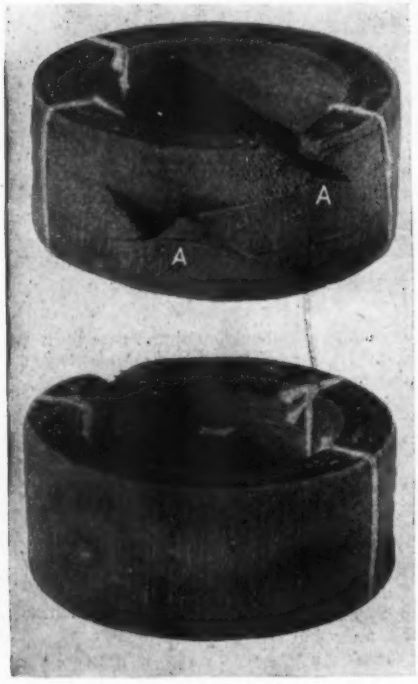


Fig. 5—Packing removed from service shows damage from excessive swelling

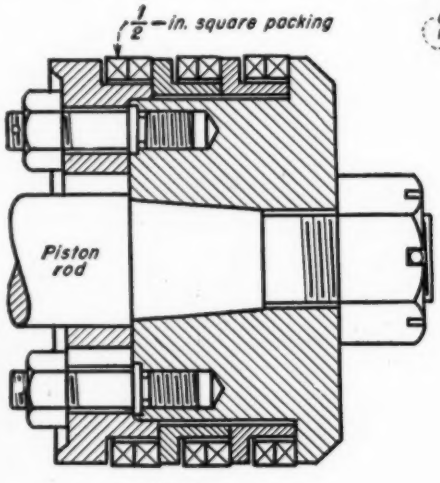


FIG. 6

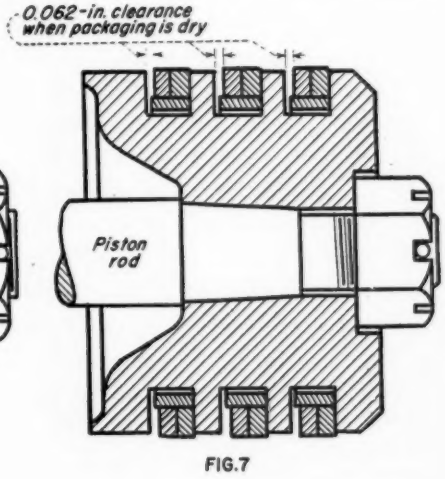


FIG. 7

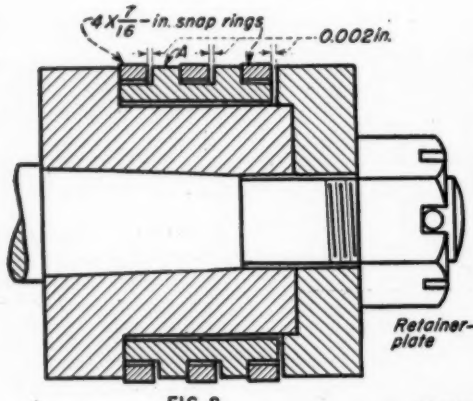


FIG. 8

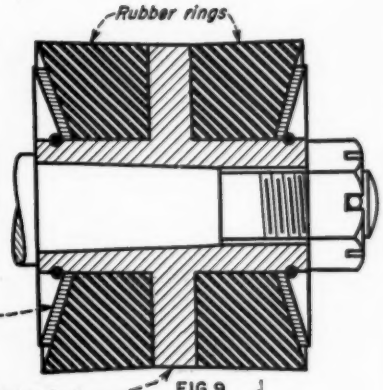


FIG. 9

Fig. 6—In piston for bakelite packing, pressure is broken down gradually from groove to groove. Fig. 7—Piston for relatively high pressure packed with double-width sealing ring behind each pair of wearing rings. Fig. 8—All-metal piston packing for oil pumps. Fig. 9—Piston packed with solid rubber rings

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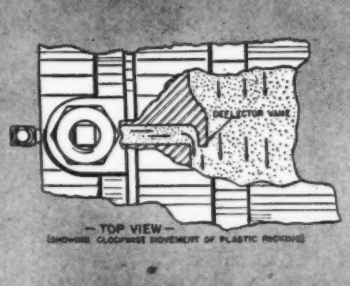
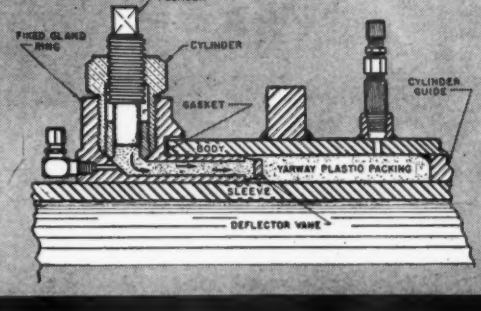
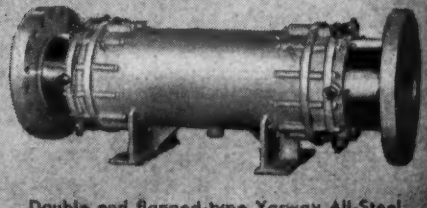
Maintenance man servicing a typical Yarway Gun-Pakt Joint







Double end flanged-type Yarway All-Steel Gun-Pakt Joint, 300 lbs. pressure.

YARWAY GUN-PAKT EXPANSION JOINT

PUMP Q&A
Continued

between packing and cylinder bore, starting at first packing ring. On reversal, packing transfers its sealing contact to piston's other end. Such packing must be fitted with enough clearance to permit this floating action, and individual rings must have end clearance to prevent jamming and interference.

If piston and follower clamp the packing when first installed or packing swells so its movement is restricted, slight wear permits excessive leakage, or excessive friction causes short strokings and other irregularities. Fig. 5 shows a set of packing in which swelling caused excessive friction and severe liner wear. Operation in the resulting oversize bore opened the gap in each ring, permitting the adjacent rings to swell into the space thus formed, as at *A*.

Q 10—How does the action of a relatively hard packing on a piston differ from that of a soft, fibrous one?

A—A relatively hard packing, such as bakelite-impregnated canvas, used extensively for boiler-feed pumps at pressures and temperatures too great for soft packings, often fails to seal between individual rings when multiple rings are used in a single groove. This causes rapid wear of the two end rings while the intermediate rings are doing no work. Fig. 6 shows a piston for bakelite packing in which pressure is broken down gradually from groove to groove and wear is divided between all packing rings.

Q 11—What is the function of a sealing ring placed behind the wearing rings of a piston packing assembly?

A—Packing rings must always be installed with enough gap between their ends to keep them from butting tightly together when the packing swells in service. Unless some means is used to seal this gap it permits leakage from behind the last ring in each groove. Fig. 7 shows a piston for relatively high-pressure packed with a double-width sealing ring behind each pair of wearing rings to seal this gap.

Q 12—What two basic types of packing rings are used on both pistons and rods or plungers?

A—They are the square packing rings, Fig. 1 and 3, and self-sealing ring or cup, Fig. 2 and 4. In the first type, fluid pressure on the end or inside of the ring holds the entire face of the packing in sealing contact. In the second, fluid pressure in the flexible lip acts to maintain contact.

Q 13—How does a cup packing, Fig. 4, seal a pump piston?

A—Fluid pressure on the cup's inside sets the lip out against the cylinder bore, forming a tight seal with a small area of contact. On a double-acting piston two cups are placed back to back, Fig. 4, and the leading cup seals in each direction of motion. Cup piston packing is one of the oldest and simplest forms. Until recently it has had relatively little use in pumps, except at low pressure because of concentration of wear at the cup's heel, which made its life too short. Development of rubber-compound-and-fabric cups capable of long life under severe conditions has led to more general acceptance of this form of packing.

Q 14—What is a bull and snap-ring packing, and when is it used?

A—It is an all-metal piston packing used on oil pumps; Fig. 8 shows a common form. Spacer *A* is a solid metal ring, which fills most of the packing space of an ordinary follower-type piston. The snap rings are conventional iron or bronze piston rings with an angle or step-cut joint. Their natural tension keeps them in contact with the cylinder liner assisted by the fluid pressure under the ring. A tighter packing of this type may be obtained by using a 2- or 3-piece compressor ring in each groove.

Q 15—What type of packing is used on the pistons of mud pumps for oil-well drilling?

A—Usually a solid-rubber packing of the flexible-lip type is used for this severe service. The heavy rubber disks, which make up most of the piston, may be clamped between retainer plates on either side of the piston body, Fig. 9, or may be bonded to the piston body.

Q 16—What type of stuffing box is used for high-temperature pumps?

A—Fig. 10 shows a stuffing box for temperatures of 500 F and higher. The stuffing box and extension are jacketed for watercooling and the piston-rod section, which comes in contact with the packing, does not travel beyond the inclosing sleeve and hence does not reach the hot liquid. Large plunger pumps for high-temperature oil have, in addition, hollow plungers inside of which cooling water is circulated.

Q 17—What procedure should be followed in packing a deep stuffing box for high pressure?

A—For self-sealing chevron packing, each ring should be snugly seated before adding the next one. But do not pull gland hard against the packing because it depends on the free action of each lip and must not be solidly compressed. Square packing requires the opposite treatment. Each ring is compressed into firm contact with the plunger and stuffing-box bore by split spacers and the plunger gland before adding the next ring. After the last ring is in place, back off the gland slightly to permit normal leakage and expansion under running heat. Heavy gland pressure cannot compensate for loosely installed rings at the bottom of a deep stuffing box. Instead, a gland that is too tight will soon destroy the first few rings of packing and damage the plunger.

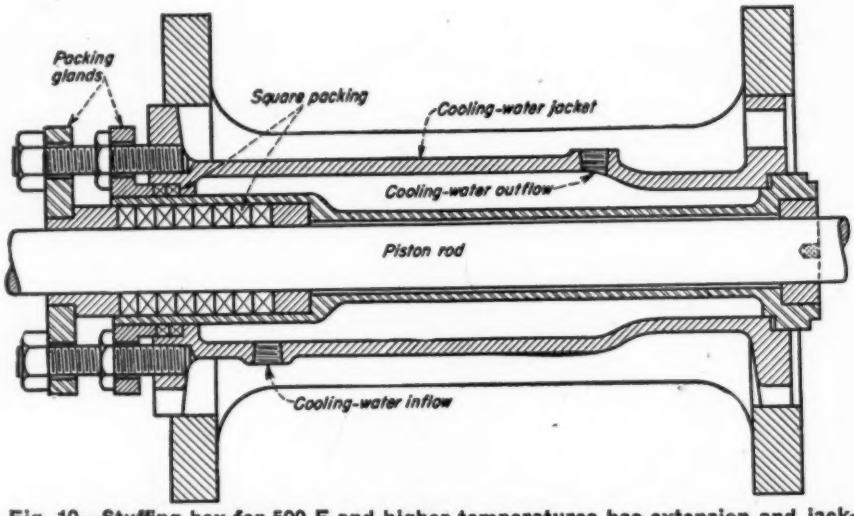
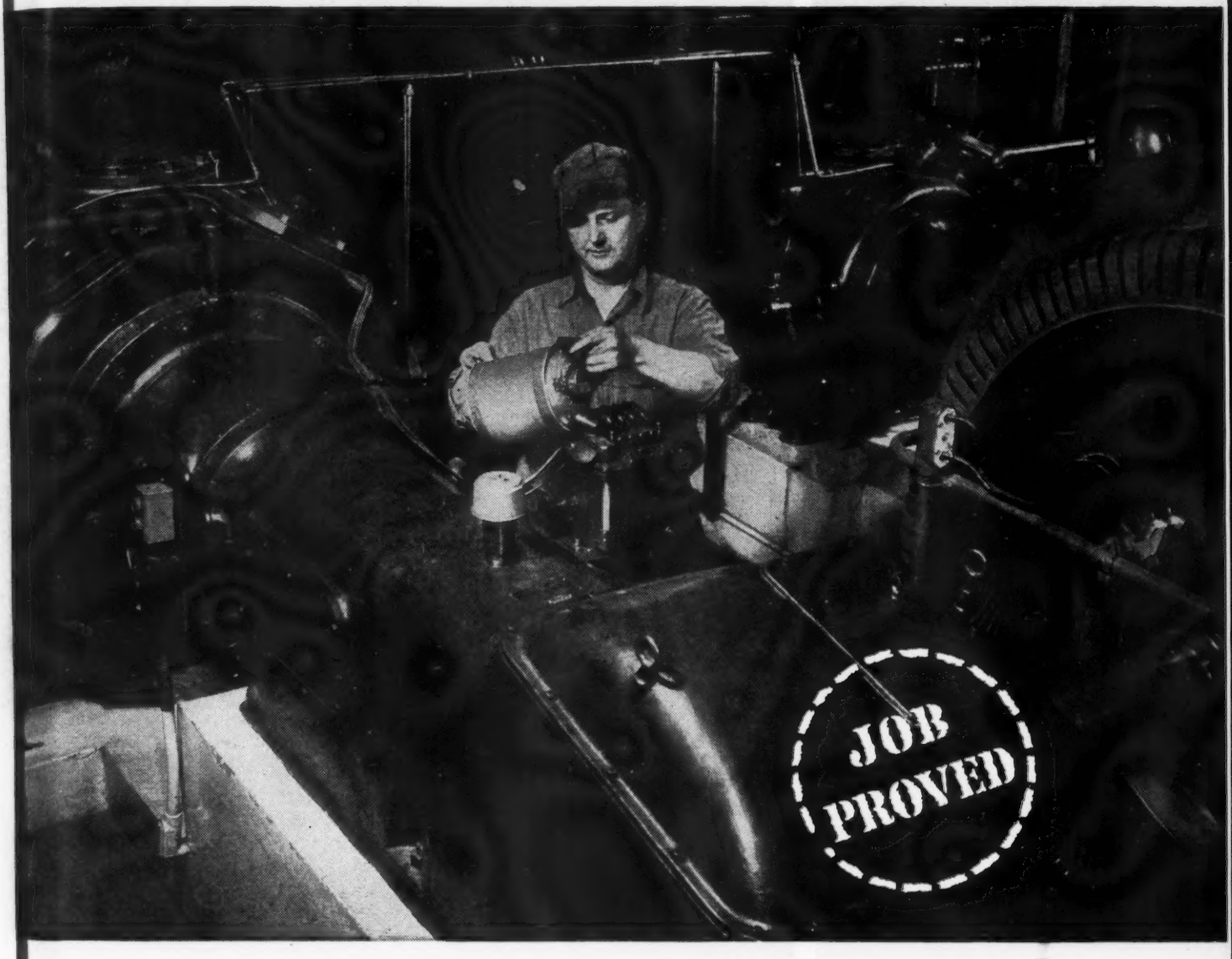


Fig. 10—Stuffing box for 500 F and higher temperatures has extension and jacket for watercooling. Piston-rod section in packing doesn't go into the cylinder

Three Years Without a Shut-Down



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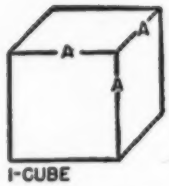
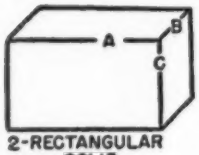
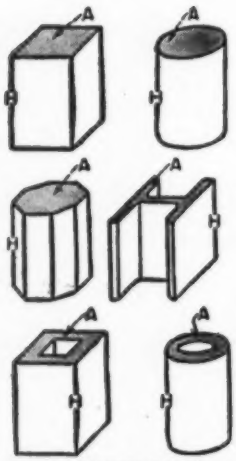
24—Useful Facts From Geometry: 4



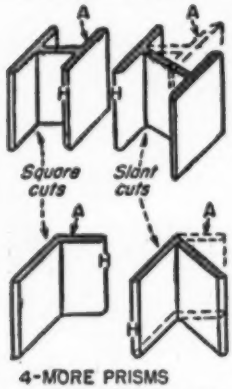
1-CUBE



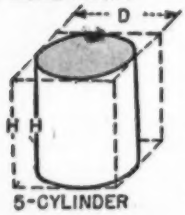
2-RECTANGULAR SOLID



3-PRISMATIC SHAPE



4-MORE PRISMS



5-CYLINDER

▶ HERE are handy rules for the volumes and surface areas of common geometrical solids:

1 *Volume* of a *cube* is the cube of its edge: *Volume* = $A \times A \times A$.

Surface area of a cube is 6 times the square of its edge: *Surface* = $6 \times A \times A$.

2 *Volume* of any *rectangular solid* (all edges square) is the product of the three dimensions: *Volume* = $A \times B \times C$.

Surface area is sum of areas of sides: *Surface area* = $2 \times A \times B$ plus $2 \times B \times C$ plus $2 \times A \times C$.

3 *A prismatic shape* is any shape that can be extruded, such as square, round or hex rod, tubing, I-beams, ells, etc. If the ends of a prismatic shape are cut off square, resulting solid is a right prism. *Volume* of any *right* prism is cross-sectional area times height or length: *Volume* = $A \times H$.

Total outside *surface area* is twice the section area, plus the perimeter of the section times the height or length: *Surface area* = $2A$ plus $H \times$ perimeter.

4 If the prismatic shape is sawed off on a slant (not square) the volume is still the product of height and section area, as before, if the two cuts are parallel. Section area A must be measured on the square, not along surface of cut. Thus the slant-cut pieces pictured have the same volume and weight as the corresponding square cut pieces.

5 *Right circular cylinder* is the geometrical name for a circular shape or prism (round rod) cut off square at both ends. *Volume* is area of circle times height: *Volume* = $0.7854 \times D \times D \times H$. Also volume = 78.54% of volume of box cylinder fits into.

Surface area is area of two end circles, plus perimeter times height or length. Surface area = $2 \times 0.7854 \times D \times D$, plus $3.1416 \times D \times H$.

6 The term *cone*, as used in geometry, includes not only any figure that would commonly be called a cone or pyramid, but any solid inclosed between a flat surface and lines drawn from a point not in the surface to all points on a closed figure drawn on the surface.

To get the idea more clearly, draw any closed figure (regular or irregular) on a sheet of paper. Hold a pencil point anywhere above the paper. Imagine a fan of taut strings running from the pencil point to the perimeter of the figure. These inclose a *cone* in the geometrical sense. Base of cone is merely the closed figure drawn on the paper. Height of cone is *perpendicular* distance from the point (apex) to plane of base (that is, to plane of paper).

Regardless of its shape, volume of a cone always equals one third of base area times height: *Volume* = $\frac{1}{3} \times B \times H$.

7 A *cone* with the point cut off is a *frustum*. If the cut is parallel with base, the volume is volume of full cone, minus volume of point cut off: *Volume* = $\frac{1}{3} \times B \times H$, minus $\frac{1}{3} \times b \times h$.

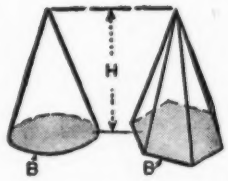
8 A *right circular cone* has a circular base and an apex perpendicularly above center of base. Its *volume* is one third the product of the area of the base circle by the height. *Volume* = $\frac{1}{3} \times 0.7854 \times D \times D \times H = 0.2618 \times D \times D \times H$ = 26.18% of volume of the box cone fits into.

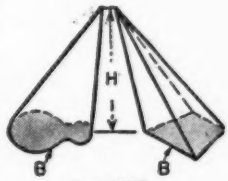
Side surface of a right circular cone is half the slant height, times perimeter of base: *Side surface* = $\frac{1}{2} \times$ slant height $\times$ 3.1416 $\times$ D = 1.5708 $\times$ slant height $\times$ D.

9 *Volume* of *sphere* = 52.36% of volume of cube it fits into. *Volume* = $0.5236 \times D \times D \times D$.

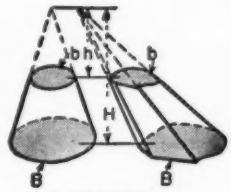
Surface equals surface area of four circles of same diameter: *Surface* = $4 \times 0.7854 \times D \times D = 3.1416 \times D \times D$.

10 *Approximate volume* of a *barrel shape* is given by the following formula: *Volume* = $0.26 \times H \times (2D^2$ plus $d^2)$ where H is height, D is middle diameter, d is end diameter.

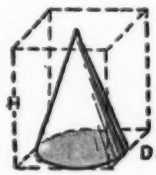




6-CONE

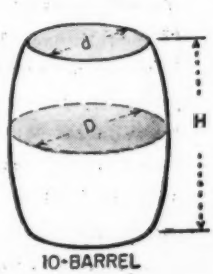


7-FRUSTUM OF A CONE



8-RIGHT CIRCULAR CONE

9-SPHERE



10-BARREL

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EValthrust Yoke Bushing—Double combination angular—radial ball bearings to insure smooth, positive closing.

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▶ THIS TWELFTH QUESTION in a series on water conditioning explains why chemical treatment finds wider use than distillation.

Goodwater Laboratory
Drum City, U. S. A.
Dear Chemist:

In my estimation, feedwater treatment is a crazy merry-go-round. First you add chemicals, supposedly to counteract others already in the water, then remove the resulting combination by discharging some of the boiler water to waste. Why not fill the boiler with distilled water and then distill more to meet makeup requirements?

Yours truly,
Walter Tender

Dear Walter:

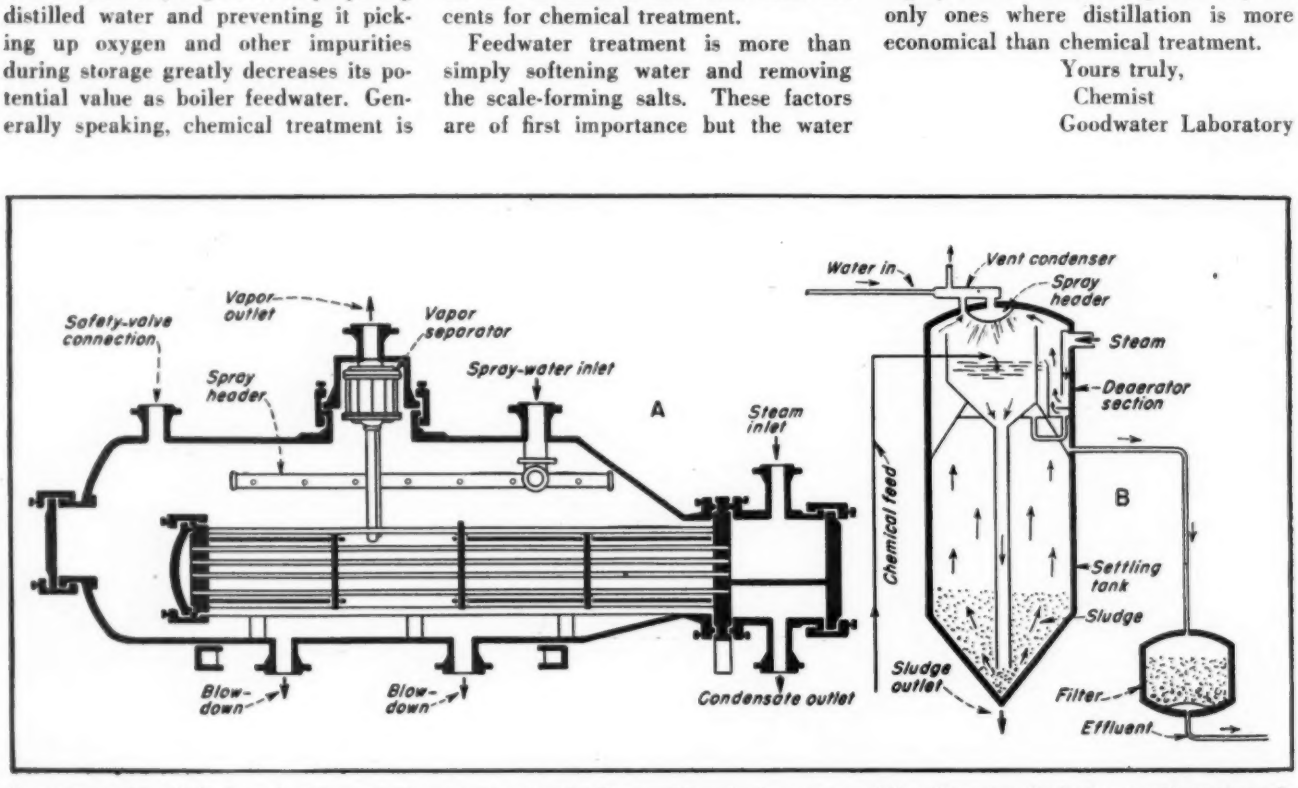
The extremely high cost of preparing distilled water and preventing it picking up oxygen and other impurities during storage greatly decreases its potential value as boiler feedwater. Generally speaking, chemical treatment is far cheaper unless the water is exceptionally hard or full of dissolved salts.

It is easier to explain this by using concrete examples, and I shall illustrate with an extremely hard and saline water that I had to study. This water had a total solids content of 1500 ppm and hardness of 800-ppm calcium carbonate. Now, assume that the efficiency of both chemical treatment and distillation process is 100%—not far off in the first but high in the second—and that the only costs to consider are chemicals and fuel; and further, that fuel costs two dollars a ton, and the chemicals 20 dollars a ton. Actually, the first price is low and the second slightly high, but even so it costs over twelve times as much to distill the water as to treat it chemically. The cost per thousand gal figures out about a dollar for distillation and less than ten cents for chemical treatment.

Feedwater treatment is more than simply softening water and removing the scale-forming salts. These factors are of first importance but the water must also be treated to prevent corrosion and caustic embrittlement and minimize any tendency to prime or foam. Relatively small amounts of chemicals are needed to accomplish the latter purposes, each chemical doing its own job. Thus the exact feedwater treatment is tailormade to suit boiler and boiler water, each installation being studied separately.

These important, though subsidiary, factors that must be included in feedwater treatment make it imperative to add chemicals to distilled water to make it satisfactory for injection into boilers. This is best illustrated by marine practice, where makeup comes from extremely saline sea water that must be distilled before use. Chemicals are added to this distillate before it goes to the boilers. Sea water and similar highly saline waters are practically the only ones where distillation is more economical than chemical treatment.

Yours truly,
Chemist
Goodwater Laboratory



An evaporator (A) manufactures makeup water by boiling contaminated water. Resulting steam is then condensed. Chemical process (B) adds chemicals to counteract scale formers in the water. Device shown also removes oxygen

26 years service for Chase National

Buildings are important tools to Chase National, one of America's largest commercial banks. Accordingly, it isn't surprising to find leading building names associated with Chase buildings. Architects, engineers and contractors connected with Chase buildings are among the best known in their respective fields.

Chase National has been a Webster Heating System user for more than a quarter century, ever since Webster Vacuum System Equipment was installed in Chase's 42 Trinity Place property in 1920.

In 1927, when the present Chase National Bank Building was erected at 15 Broad Street, a Webster Vacuum System was installed and operated without substantial modification until 1940 when, following a policy of keeping its tools sharpened, Chase's building management called in Jaros, Baum and Bolles, Engineers, for recommendations on the heating modernization program.

This was followed by installation of a three-zone Webster Moderator System incorporating expertly sized Webster metering orifices and automatic *continuous heating*, with service provided by the Webster New York Office, under the direction of John F. Hanbury. The continuous heating, a feature of the Webster Moderator System from the time of its first development, is the building management's assurance of continuous comfort for the occupants and maintained economy in the use of steam.

THE CHASE NATIONAL BANK BUILDING
15 Broad Street, New York City
One of America's Largest Commercial Banks

Erected 1927. Trowbridge & Livingston, Architects. Meyer, Strong & Jones, Engineers. Thompson-Starrett, General and Heating Contractors.

Heating Modernization 1940. Jaros, Baum and Bolles, Engineers. Child & Scott-Donohue, Inc., Heating Contractors.

John F. Hanbury
N. Y. Representative
Native New Yorker. Graduate of Cooper Union in Mechanical and Electrical Engineering. With Webster's New York office since 1919.

If your building has an outdated heating system without control or with inadequate on-and-off control, now is a good time to consider a heating modernization program. All Webster Equipment required for such a program is available for early delivery, without priority difficulties.

We solicit the opportunity to work with you as we have with Chase National.

WARREN WEBSTER & CO., Camden, N. J.
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Webster
HEATING SYSTEMS

Webster Heating Equipment for Modernization

Webster Metering Orifices, expertly sized, a vital feature of the Moderator System, balance distribution and make possible central control with continuous heating.

Webster Outdoor Thermostat Control automatically provides the lowest pressure for comfortable inside temperature.

Webster Electronic Moderator Control Cabinet provides continuous heating, always under control.

Motor Operated Webster Control Valve—specially designed to provide *continuous* controlled steam delivery in low pressure heating.

Webster Thermostatic Radiator Trap—the world's best known radiator trap.

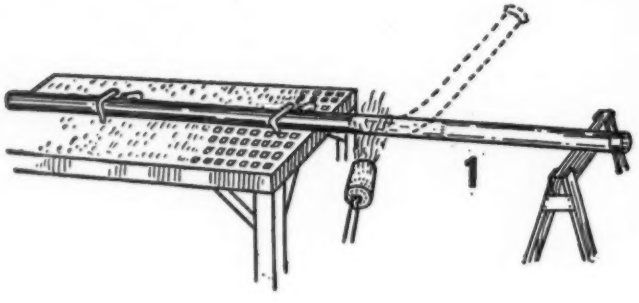
HOW TO BEND TUBING OR SMALL-SIZE PIPE

▶ WHEN BENDING PIPE, support it internally or externally to prevent wall collapse. Internal support includes filling the pipe with sand, salt, rosin or a low melting-temperature alloy. Only the first two materials can be used for hot bending. Latter two melt at 350 and 158 F respectively. Tar and lead can also be used. Procedure is to plug one end of pipe, add filler and plug open end tightly. Make sure plug reaches filling medium. With sand and salt, tap the pipe while filling to compact the material.

External support consists of encircling the tube walls with grooved rollers, a shoe and roller or a closely wound coil spring during the bending operation. A combination method supports the outer surfaces with shaped rolls and the inner with a close-fitting mandrel at the point of bending. Shaping rolls must fit pipe contour.

When hot-bending a sand-filled pipe freehand, the pipe stretches, the sand becomes loose, and pipe flattens slightly. To correct for flatness, overbend slightly and open the bend to required shape. Make short-radius bends in two steps. Bend one half of the angle and repack the sand before finishing. Use a template guide.

Whenever possible, keep pipe seams on the side of bend. Brazed-seam pipe should be bent cold with rosin filling. Anneal copper and brass before bending, either empty or filled because hard-drawn material fractures. Have sand or salt filler perfectly dry since steam generated on hot bending blows out plug or ruptures pipe. Remove rosin filling by heating the pipe; clean out adhering film with live steam, mineral spirits or kerosene. *Courtesy, Copper & Brass Research Association.*



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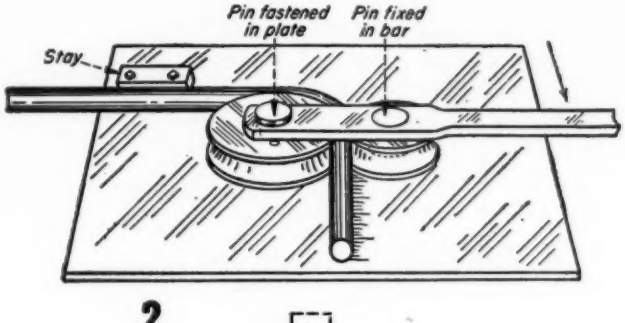

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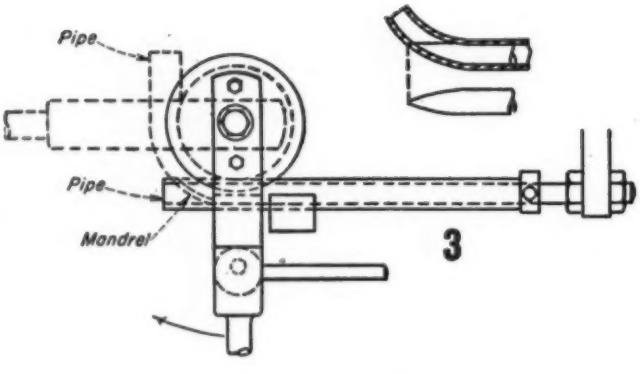

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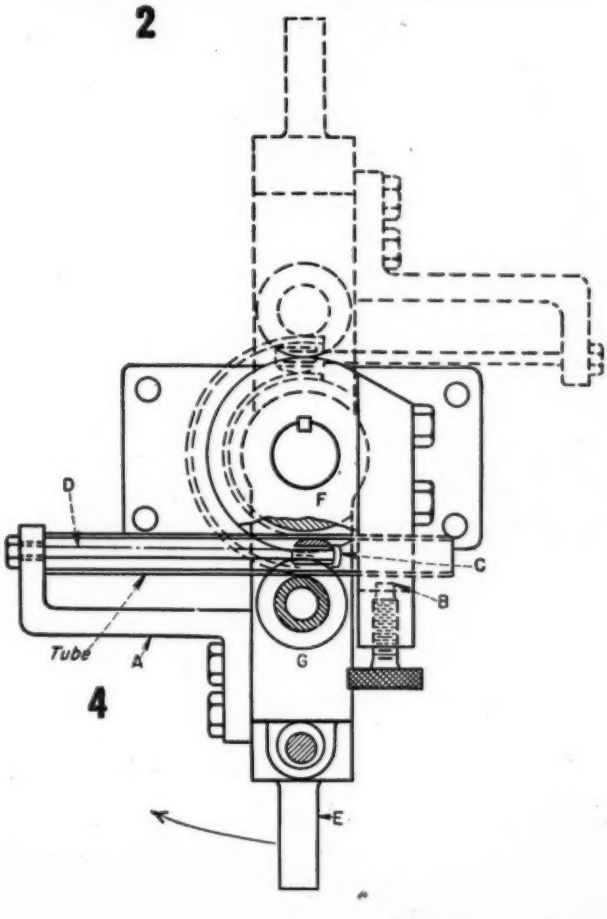

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1 Bending can be done by clamping one end of pipe to an anglesmith's slab. During heating, support the free end of pipe on a trestle. Overbend the pipe slightly if it is sand-filled; then open the bend to the correct shape.

2 Simple hand-operated jig uses a shaping wheel and roller, grooved to fit the pipe contour accurately. Used on empty pipe this device makes bends to a minimum radius of twice the pipe diameter for standard-pipe sizes.

3 Bender with a rotating form wheel pulls tubes endwise along mandrel rod. Rod end fits curved section of pipe and provides a large supporting area. Pipe can also be supported internally with a series of linked balls.

4 Tube is supported on bracket A and held against endwise movement by clamp B. Oval mandrel C, positioned inside the pipe by rod D, supports pipe walls. Moving arm E to left bends pipe between wheel F and roll G.

McCord Corporation of Detroit, Michigan, one of the country's largest manufacturers of automotive radiators, is a large user of Anaconda Copper and Copper Alloys.

Commercial and household refrigeration condensers—manufactured by McCord Corporation.

For Heating and Cooling McCord Selects COPPER

FOR OVER THIRTY YEARS, The American Brass Company has supplied the McCord Corporation—one of the largest companies in its field—with copper for heat transfer equipment, automotive radiators and space heaters.

Anaconda Copper Sheets and Tubes can be depended on for high thermal conductivity, resistance to corrosion and uniformly high quality.

For the fabricator of heat transfer equipment, The American Brass Company offers a wide choice of the highest quality corrosion resistant metals in the form of sheets, wire, rods and tubes.

ANACONDA

Anaconda

COPPER & COPPER ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

WHAT'S New IN PLANT EQUIPMENT

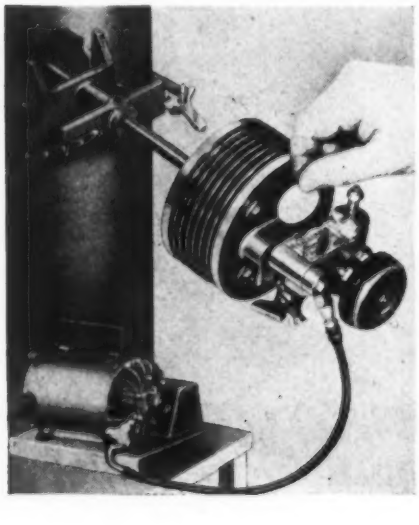
Circuit Breaker

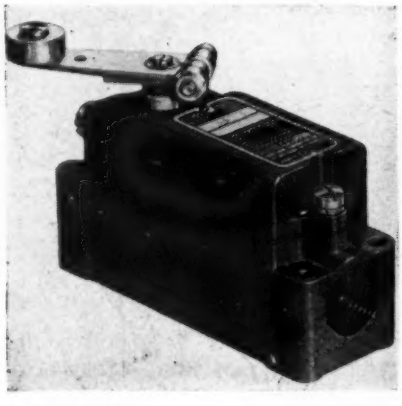
THIS CIRCUIT BREAKER provides several new refinements, chief of which is a tripping action that combines inverse time-limit characteristics of bimetal thermal action on overload with operating speed of magnetic-trip action on short circuits. *Quicklag* circuit breaker is available in single or double poles, 10 to 50 amp. 125/250 v ac. Another improvement is a redesigned deion arc chute that eliminates need for a vent screen in the bottom. This permits mounting it flush to panel and eliminates need for ⅜-in. mounting clearance formerly required. Panel design and smooth dust-free surfaces are also important improvements. **Dept P, Westinghouse Electric Corp, Pittsburgh 30, Pa.**

Smoke Tester

INSTRUMENT IS DESIGNED primarily for testing smoke density on oil-burning furnaces. The device consists of a sampling unit, which is attached to the furnace breeching, and a motor-driven vacuum pump. A time switch automatically stops the motor after one minute.

In operation the vacuum pump draws flue gas through a filter disk at controlled vacuum. Smoke particles are evenly deposited on the disk, color of exposed area varying from light grey to black. Filter disk is then removed and compared with comparator scale furnished with the instrument. This matching procedure makes it a simple matter to adjust oil burner to give the high percentage of carbon dioxide. **Dept P, Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh 8, Pa.**





Limit Switch

PRECISION SNAP SWITCH in an oil-tight inclosure is suitable for machine tool and similar applications. The unit is available in surface and flush housings with either roller-arm or push-rod operating mechanism. The die-cast inclosure with *Corporene* gasket is oil-tight and dust-tight, and is suitable for mounting in one of several positions.

Roller-arm designs require only 5-deg travel for operation, but are provided with a 25-deg over-travel in either direction. The arm is adjustable to any position around a complete circle. Return springs are easily reversed for clockwise or counter-clockwise motion of lever, or are removable for maintaining-contact action. Operating arms are available in various lengths from ½ to 3 in. with standard-hardened steel rollers. **Dept P, Square D Co, 4041 N Richard St. Milwaukee 12, Wis.**

High-Pressure Valve

NEW VALVE FEATURES plastic packing, welded bonnet construction and lubricated stem. Valve comes with screwed or flanged ends in 2-in. sizes of 1000-, 1500-, 2000-, 3000- and 4000-psi test pressures. **Dept P, Orbit Valve Co, Tulsa 1, Okla.**

Refractory Cement

HIGHLY WORKABLE, AIR-SETTING CEMENT serves as a bonding mortar with firebrick and insulating firebrick. Its manufacturer claims (1) selection of refractory clays enables *Air Set* to meet 2910-F duty (2) cold-bonding strength of cement is three times the 200-psi ASTM specification.

Additional features claimed for this product are (1) no deterioration in storage (2) ease of pouring and thinning and (3) when applied, a tight joint capable of withstanding abrasion, slagging and spalling as effectively as the brick itself. Mixed cement is available in 16-, 50-, 95- and 185-lb steel drums. **Dept P, Building Materials Div, Armstrong Cork Co, Lancaster, Pa.**

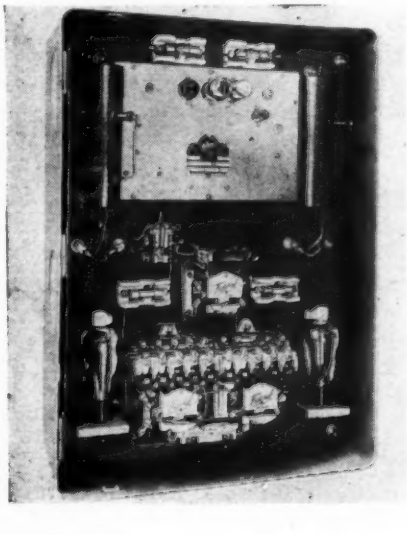
Welding Electrode

W-2075 ELECTRODE, for welding cast iron where the weld must be machinable, is composed of pure nickel core wire and an extruded covering that is consumed in the arc and produces very little slag. The stabilizing ingredient makes this electrode useful on ac and dc (reverse polarity).

Electrode may be used in all welding positions. Nickel deposit eliminates the hard zone found in welds made with mild-steel electrodes on cast iron. Color match is close and welds are not readily detected on machined surfaces. **Dept P, General Electric Co, Schenectady 5, N. Y.**

Electronic Motor Control

NEW ELECTRONIC MOTOR CONTROL operates dc motors from an ac-power source. This device regulates motor speed and provides an almost flat speed-torque curve upon which changes in load have very little effect. Speed adjustment is variable through a wide range and at any setting



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40 to 60% LESS WEIGHT!

New CRANE PRESSURE-SEAL BONNET VALVES

The scales show this weight-saving achievement . . . with no loss of strength . . . that cuts piping erection and maintenance costs. Note comparative weights of this new Crane design and the conventional 1500-Pound Steel Gate Valve, both 8-inch. Size for size, here is amazing weight-reduction . . . 40% to 60% . . . depending on size.

OTHER BASIC ADVANTAGES OF THIS NEW PRINCIPLE

1. *Eliminates Bonnet Joint Leakage*
2. *Ends Bonnet Joint Maintenance*
3. *New Streamlining . . . inside and out*
4. *New Ease of Inspection*
5. *New Ease of Operation*
6. *Improved Flow Characteristics*
7. *Reduced Over-all Dimension*

REVOLUTIONARY DESIGN IN STEEL VALVES FOR HIGH PRESSURES AND HIGH TEMPERATURES

No valve improvement in a quarter-century compares with the Pressure-Seal Bonnet principle. It completely eliminates the customary flanged bolted bonnet joint with its problems of leakage and maintenance. The joint is inside the valve—automatically sealed by fluid pressure. This new principle, as applied by Crane, brings a whole new set of standards for on-the-job valve efficiency.

The Crane Pressure-Seal line includes gate, globe, angle, and automatic stop-check patterns with welding ends. Complete information regarding performance and adaptability to your requirements supplied on request.

1500-Pound Crane Pressure-Seal Bonnet Globe Valve

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas.

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

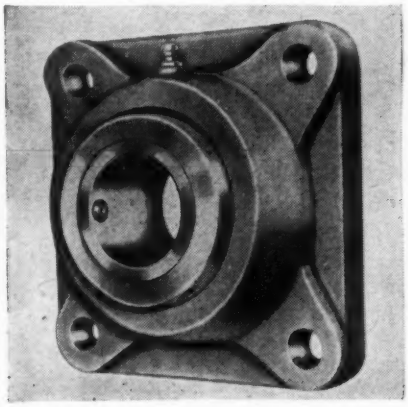
performance is practically equal to that of a synchronous motor, even with suddenly applied load.

Precise automatic current-limiting feature makes it possible to preset the maximum allowable armature current on the motor. Electronic circuits limit the current to the preset value, regardless of load, even under locked armature conditions. The automatic current limiting feature also gives smooth, stepless acceleration from standstill to full speed without drawing excessive current from the line. This feature protects motor and control in case of an overload, and also protects load since current-limiting action is also torque-limiting. **Dept P, Federal Electric Products Co, 50 Paris, Newark, N. J.**

Precision Needle Valve

PRECISION NEEDLE VALVE serves for gage, metering and instrument lines on high-temperature, high-pressure or corrosive services. Positive back seating allows valve to be repacked under full-line pressure. A metal-to-metal line seal at the bonnet eliminates gaskets. Valve combines positive shutoff with micrometer throttling action. Entire valve stem, including ball seat and tapered tip, is constructed of specially heat-treated and work-hardened stainless steel, ground and polished to eliminate possible galling and wire drawing. Valve body is machined from solid-rolled stock.

Valve is available in both straight and angle types in sizes from ⅛ to ¾ in. for working pressures up to 3000 psi, and temperatures up to 750 F. They are made from cadmium-plated carbon steel, 12-14% chrome, *Type* 416; or 18-8 stainless steel, *Type* 316; or special alloys to meet any desired specification. **Dept P, Kerotest Mfg Co, Pittsburgh 22, Pa.**

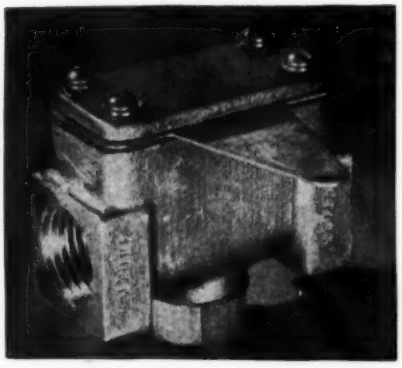


Ball-Bearing Unit

FULLY SELF-ALIGNING ball-bearing flange unit has deep-groove precision ball bearings with long inner race, improved labyrinth seals, and is suitable for mounting against vertical or horizontal frames and supports. Housing's back face is machined and has filling slots that provide added protection against dirt and dust getting into the bearing. This bearing is an addition to a complete line of ball bearings available in pillow blocks, hangers, take-up and cylinder units, and steel-frame ball-bearing take-ups. **Dept P, Dodge Manufacturing Corp, Mishawaka, Ind.**

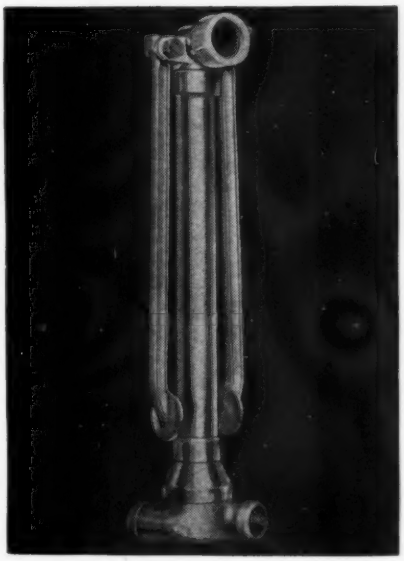
Magnetic-Control Device

NEW MAGNETIC CONTROL device uses *Curie Point* metals, which are carefully prepared alloys of iron and other elements characterized by their valuable magnetic properties, both in the cool and heated state. When the alloy is cool it has high permeability and when heated through its critical temperature range it changes to a paramagnetic condition with an exceptionally low permeability. The reversible magnetic change has an indefinite life and always occurs at exactly the same fixed temperature. When cool, the alloy is strongly attracted to a magnet. When heated through its temperature range it is no longer attracted and will fall, or can be forced away. Upon cooling, it will again snap up to the magnet.



Alloys are available that operate controls at any selected temperatures from 180 to 1000 F. They can be submerged in liquid or imbedded in nonmagnetic substances, such as plastics, lead and glass, and still show consistent performance. Such controls can be applied to apparatus or processes that depend on the presence or absence of heat for operation, or which are to be held or protected at one fixed temperature. The valve shown is operated by a gas pilot flame for single-point ignition. When the pilot light is extinguished the *Curie Point* metal is cold and the permanent magnet is attracted to it, firmly holding the valve closed. Valve can be applied to unit heaters, floor furnaces, circulating heaters, central-heating plants, water heaters, refrigerators and gas burners as protection against failure of the pilot light.

Manufacturer says these alloys can also be imbedded in bearings to operate a warning device or to break an electric circuit if excessive temperatures develop. They can also be used in limit switches, electric switches, electric circuits, on flash boilers and engine manifolds. **Dept P, Curie Point Alloys Co, 612 N Michigan Ave, Chicago 11, Ill.**



Hose Nozzle

A NEW WATER FOG NOZZLE is designed for fighting fires beyond partitions, below floors, above ceilings, or under piers and bridges. Nozzle carries arms that extend horizontally to prevent it from dropping through a hole prepared for it, and also to steady nozzle when it is in operation. The arms can be folded, making a compact unit. Nozzle is long enough to clear beams, joists and other obstructions when inserted through a wall or partition, floor

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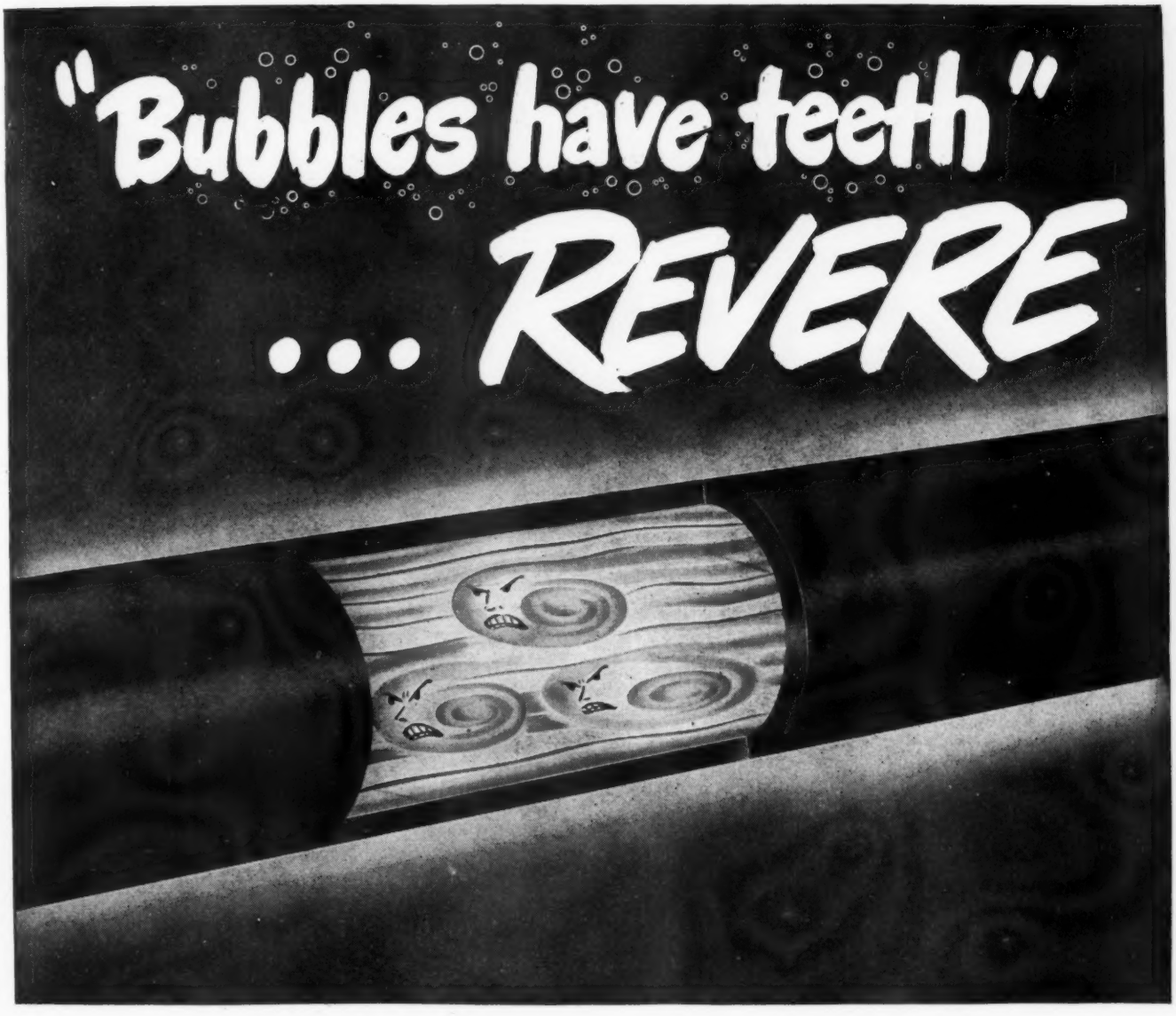


SOME years ago Revere said that "Bubbles have teeth." It is still true. Air bubbles in a condenser can eat away at the tubes quite rapidly, and become a cause of failure with consequent re-tubing. Air-entrainment, as it is called, acts in several ways, all destructive to tubes. Air contains oxygen, which directly attacks most metals, forming oxides. Carbon dioxide in solution dissolves these oxides. That is not all. Air bubbles add to the erosion effect of turbulent flow. The higher the velocity, the worse the effect, and the more swift and serious is the combination of erosion and corrosion at points of greatest disturbance. Every effort should be made therefore to keep air from being carried into the cooling water. If you are troubled by frequent re-tubing of your condenser, get in touch with Revere, but first save a few samples from failed tubes for examination by our laboratories to determine the cause of failure. Many users of condenser tubes have found our collaboration exceedingly valuable, and we are always glad to cooperate in an effort to extend tube life.

REVERE

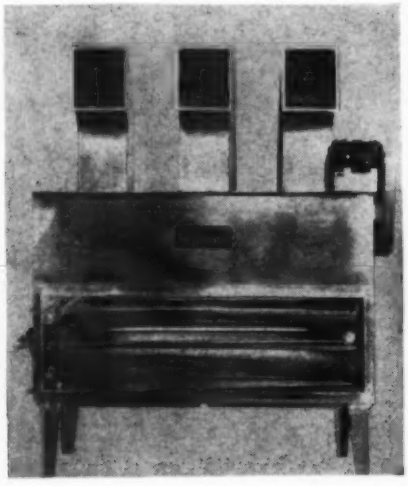
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

or ceiling. The head rotates without leakage or friction on high-quality thrust bearings. It is available in 1½- and 2½-in. sizes for fire-hose lines. Nozzle operates effectively at pressures above 30 psi. **Dept P, Rockwood Sprinkler Co, 38 Harlow St, Worcester, Mass.**



Space Heater

NEW HEATER uses latent and sensible heat of steam. High-pressure steam is condensed in a finned coil; the condensate flows into a trap from which it is admitted to regenerative vapor coil where it flashes into vapor. High-pressure condensate remaining liquid at this point is drained directly to final condensate return header by a hairpin-bend tube from which condensate gives up its heat to air stream. A weir in the condensate-return header keeps liquid level high where it is in contact with cold incoming air. This subcools the condensate below its relative return temperature. The weir contains a bleed hole for draining condensate upon shutdown. Vacuum return is vapor free. Condensate returns without flashing at low pressure and temperature. **Dept P, Niagara Blower Co, 405 Lexington Ave, New York 17, N. Y.**

Oil Filter

THIS FILTER consists of a replaceable cartridge mounted inside a steel shell capable of withstanding high pressures. Total capacity is 15 lb of sludge—1½ times its own weight. Filter element is composed of a cylindrical stack of cellulose disks tightly bound to form a compact cartridge. Each disk contains a unique pattern of concentric circular holes forming numerous small passages that serve to expand the filtering area and provide a large space for trapping sludge and dirt. Access to cartridge is through top of container where a single nut holds lid in place. A wire handle on each cartridge permits easy insertion and removal.

Clean-oil outlet is through a perforated tube in the center, around which filter cartridge is placed. Oil entering container passes through disk and between the edges.

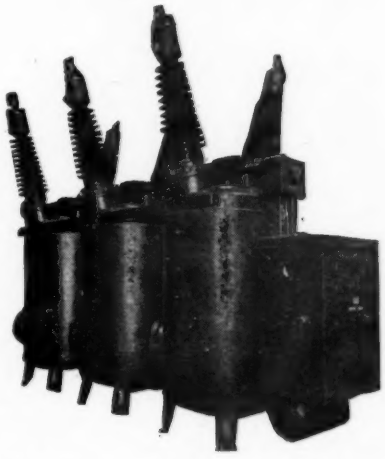
Available models are the *ED*-10 for low viscosity and lightly contaminated oil, *ED*-10*H* for more viscous and highly contaminated oil, and a series called *ED*-20 and *ED*-20*H*. *ED*-20 and *ED*-20*H* are composed of two Model *ED*-10 and *ED*-10*H* filters, respectively, mounted on a common base and connected in parallel. Larger units can be built up in similar arrangements to obtain unlimited flow rates. **Dept P, Youngstown Miller Co, 675 Main St, Belleville, N. J.**

Hydraulic Accumulator

FULL-FLOW HYDRAULIC ACCUMULATOR uses one-piece seamless-steel shell inclosing an air bladder made of special natural or synthetic rubber, depending on fluid in the system. Bladder has integrally molded high-pressure automotive air valve on one end for preloading it with air pressure, and an integrally molded conical metal plug on the other end for sealing shell at end of oil-drainage cycle. Metal plug eliminates direct contact between rubber bladder and outlet. Bladder serves as permanent wall between air and oil chambers, stands operating temperatures from 200 to —40 F, and retains its air charge for three months without attention. **Dept P, Greer Hydraulics, Inc, 454 18th St, Brooklyn 15, N. Y.**

Welding Fittings

NEW LINE OF WELDING FITTINGS consists of 90- and 45-deg elbows, 180-deg return bends, straight and reducing tees, concentric and eccentric reducers, caps, lap-joint stub ends, saddles, shaped nipples, crosses and tees in carbon steel, in sizes up to 30 in. Fittings are designed and manufactured in accordance with recommendations of the American Standards Association and other standards. Manufacturer claims uniform wall thickness, accurate circularity, full effective radii, smooth inner walls and machined bevel ends on these seamless welding fittings. **Dept P, Ladish Co, Cudahy, Wis.**



High-Voltage Circuit Breaker

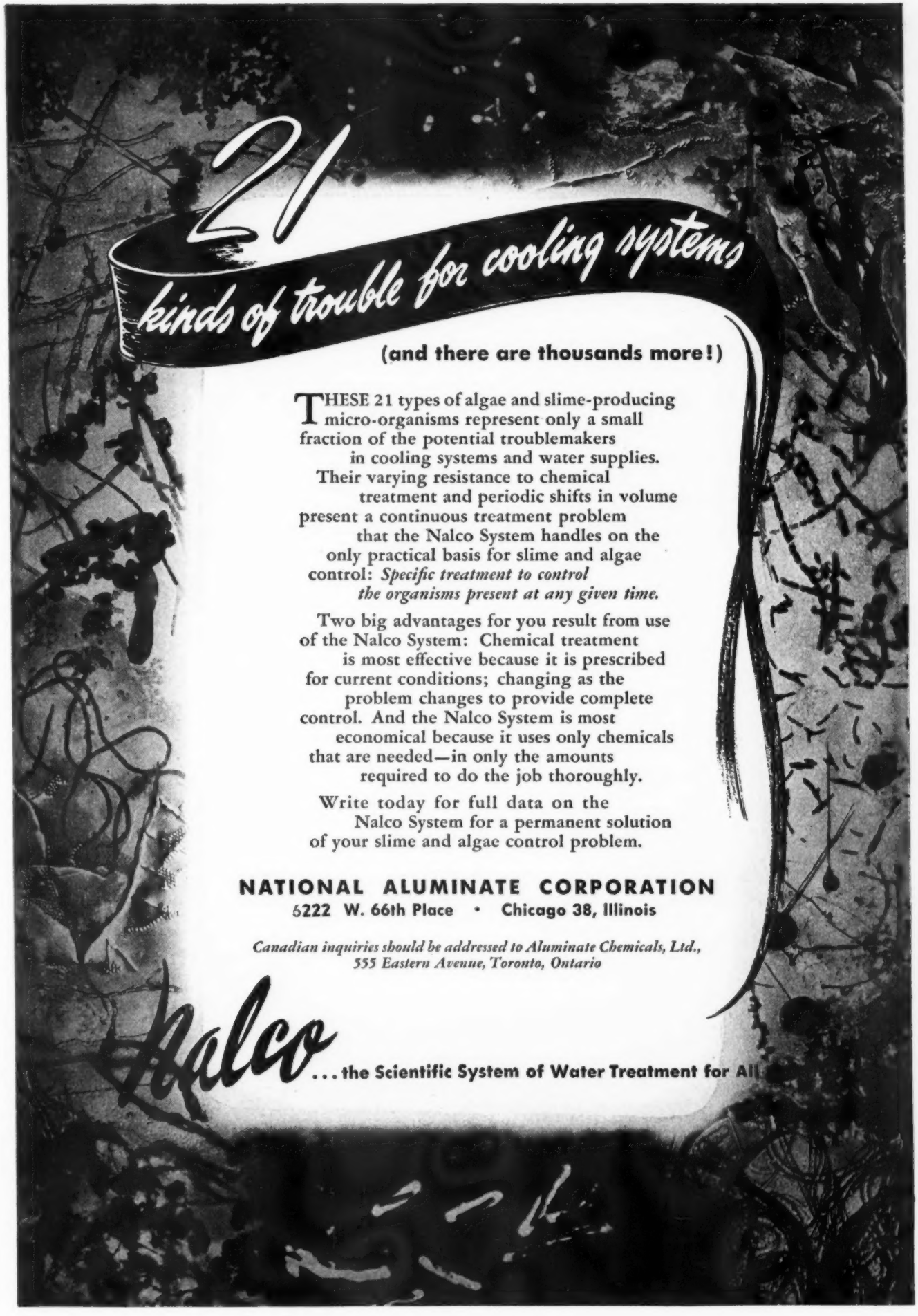
THIS HIGH-VOLTAGE oil-blast circuit breaker has completely sealed bushings, simplified lightweight multi-break interrupter, a pneumatic-operating system and reduced tank diameter. It has voltage ratings of 115 to 230 kv, with interrupting ratings of 2500 mva at 115 kv, and 3500 mva at 138 to 230 kv.

Bushings on the breaker are compactly designed, which creates space for two current transformers on each bushing and permits a total of 12 transformers per breaker. Current transformers can easily be drawn over lower end of bushings and removed through manholes for servicing. Multi-break interrupting contacts of simplified construction serve for all ratings, although at 230 kv an additional pair of breaks are used, making a total of six per interrupter at this voltage. A compact, parallel resistor on each interrupter provides positive control of over-voltages that accompany interruptions of line-charging current.

A pneumatic mechanism provides high-speed reclosing of breaker. Operating unit comes self-contained, complete with air compressor. Smaller control batteries and

(*Continued on page* 160)

POWER brings this monthly survey of new equipment as one of its many reader services. In requesting additional information from manufacturers, please identify the source of your inquiry by referring to Dept. P


21
kinds of trouble for cooling systems
(and there are thousands more!)
THESE 21 types of algae and slime-producing micro-organisms represent only a small fraction of the potential troublemakers in cooling systems and water supplies. Their varying resistance to chemical treatment and periodic shifts in volume present a continuous treatment problem that the Nalco System handles on the only practical basis for slime and algae control: Specific treatment to control the organisms present at any given time.
Two big advantages for you result from use of the Nalco System: Chemical treatment is most effective because it is prescribed for current conditions; changing as the problem changes to provide complete control. And the Nalco System is most economical because it uses only chemicals that are needed—in only the amounts required to do the job thoroughly.
Write today for full data on the Nalco System for a permanent solution of your slime and algae control problem.
NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario
Nalco ... the Scientific System of Water Treatment for All

How to plan

MEDIUM *and* LOW PRESSURE DISTRIBUTION

from a

HIGH PRESSURE STEAM PLANT

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

● **When steam is generated at high pressure,** provision must usually be made for medium and low pressure steam distribution. For example, steam generated at 450 p.s.i. might be reduced to 100 p.s.i. for the operation of steam driven auxiliaries, and further reduced to 5 p.s.i. for heating purposes. The diagram shows a typical pressure reduction hookup.

The two pressure reducing stations are identical in layout. Each is provided with a pressure reducing valve good for dead end service, gate valves for shut-offs, and globe valves in the by-passes. Pressure gages are installed on both the high and low side, and a safety valve on the low side guarantees against the possibility of pressure-reducing valve failure. Where large reductions in pressures are required, two stages are often advised, with reducing stations duplicated completely.

The boiler feed pump steam engine drive is controlled responsive to boiler feed line pressure, and a manual by-pass around the control valve is provided.

Cast steel gate and globe valves are recommended throughout the high pressure system, and bronze and iron body valves in the medium and low pressure systems. Outside screw and yoke gate valves with rising spindle are indicated where positive shut-off at infrequent intervals is required, and where it is necessary to determine quickly if the valve is open or closed.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

22

Fig. 47
Bronze Gate Valve
Solid Wedge
Inside Screw
Traveling Spindle
125 Pounds Steam at 500°F.
200 Pounds O.W.G.

Other types and pressure ranges of Jenkins Valves can be used for this type of layout, according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Copies of Layout No. 22 will be furnished on request . . . also copies of future Piping Layouts. Just fill out and mail the coupon.

The Fig. 47 Bronze Gate Valve used in this layout is excellent for steam, water, oil and gas lines, where full, free flow is required. A reversible, taper wedge, with deeply-milled lugs for liberal bearing engagement, resists effects of rapidly vibrating steam currents. The traveling spindle indicates position of wedge, lifts wedge entirely clear of line of flow when valve is fully open.

A CHOICE OF OVER 600 JENKINS VALVES

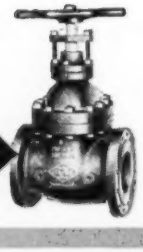
To save time, to simplify planning, to get the advantage of Jenkins specialized valve engineering experience,—select all the valves you need from the Jenkins Catalog. It's your best assurance of *the lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; San Francisco; Chicago; Jenkins Bros., Ltd., Montreal

JENKINS VALVES

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK



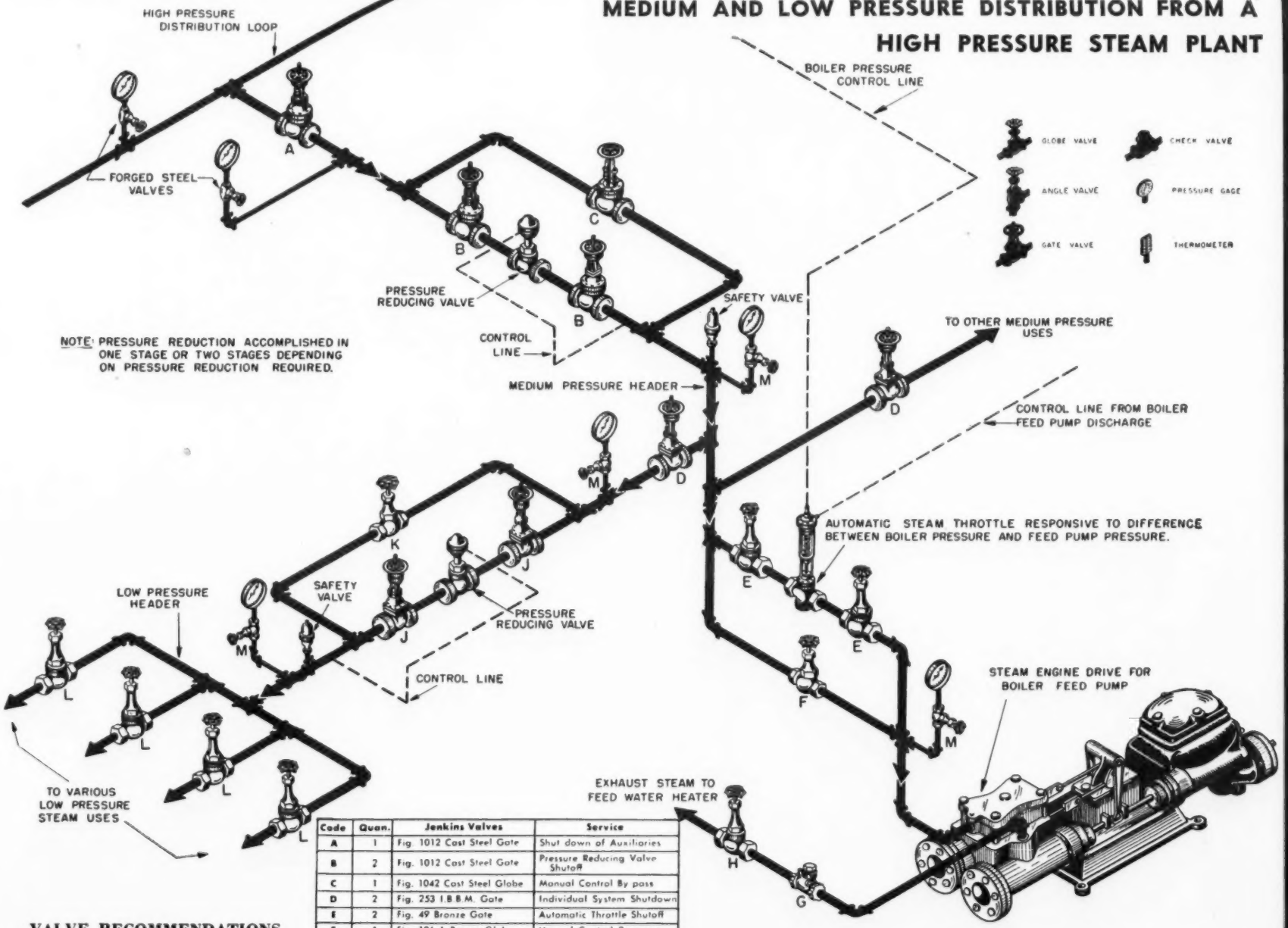
125 TO 600 LBS. STEAM PRESSURE

Jenkins Bros

BRONZE * IRON * STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE
SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

MEDIUM AND LOW PRESSURE DISTRIBUTION FROM A HIGH PRESSURE STEAM PLANT



Code	Quan.	Jenkins Valves	Service
A	1	Fig. 1012 Cast Steel Gate	Shut down of Auxiliaries
B	2	Fig. 1012 Cast Steel Gate	Pressure Reducing Valve Shutoff
C	1	Fig. 1042 Cast Steel Globe	Manual Control By pass
D	2	Fig. 253 I.B.B.M. Gate	Individual System Shutdown
E	2	Fig. 49 Bronze Gate	Automatic Throttle Shutoff
F	1	Fig. 106 A Bronze Globe	Manual Control By pass
G	1	Fig. 92 Bronze Swing Check	Back flow check
H	1	Fig. 47 Bronze Gate	Steam Engine Exhaust
J	2	Fig. 253 I.B.B.M. Gate	Pressure Reducing Valve Shutoff
K	1	Fig. 106 A Bronze Globe	Manual Control By pass
L	4	Fig. 47 Bronze Gate	Individual Shutdowns
M	4	Fig. 106 A Bronze Globe	Pressure Gage Control

VALVE RECOMMENDATIONS

For details – and valves to suit varying conditions – see Jenkins Catalog

Diagram by Huxley Madeheim, Consulting Engineer

JENKINS BROS., 80 White St., New York 13, N. Y.
Please send me a reprint of Piping Layout No. 22 and future layouts as they become available.

Name .....
Company .....
Address .....

POWER'S DATA SHEETS

Number 177

Hydraulic Friction Chart*

By P J POTTER,
University of North Dakota

HERE'S A MEANS of quickly finding friction loss and water velocity in given pipe sizes for water flows varying from 10 to 100,000 gpm. This chart is based on the William and Hazen formula for average pipe conditions; for other pipe conditions use the correction factors in table at the right.

Example: Find the friction loss and water velocity when 900 gpm of water flows through a 6-in. schedule-40 (standard weight) pipe whose equivalent length is 435 ft. Pipe condition is average.

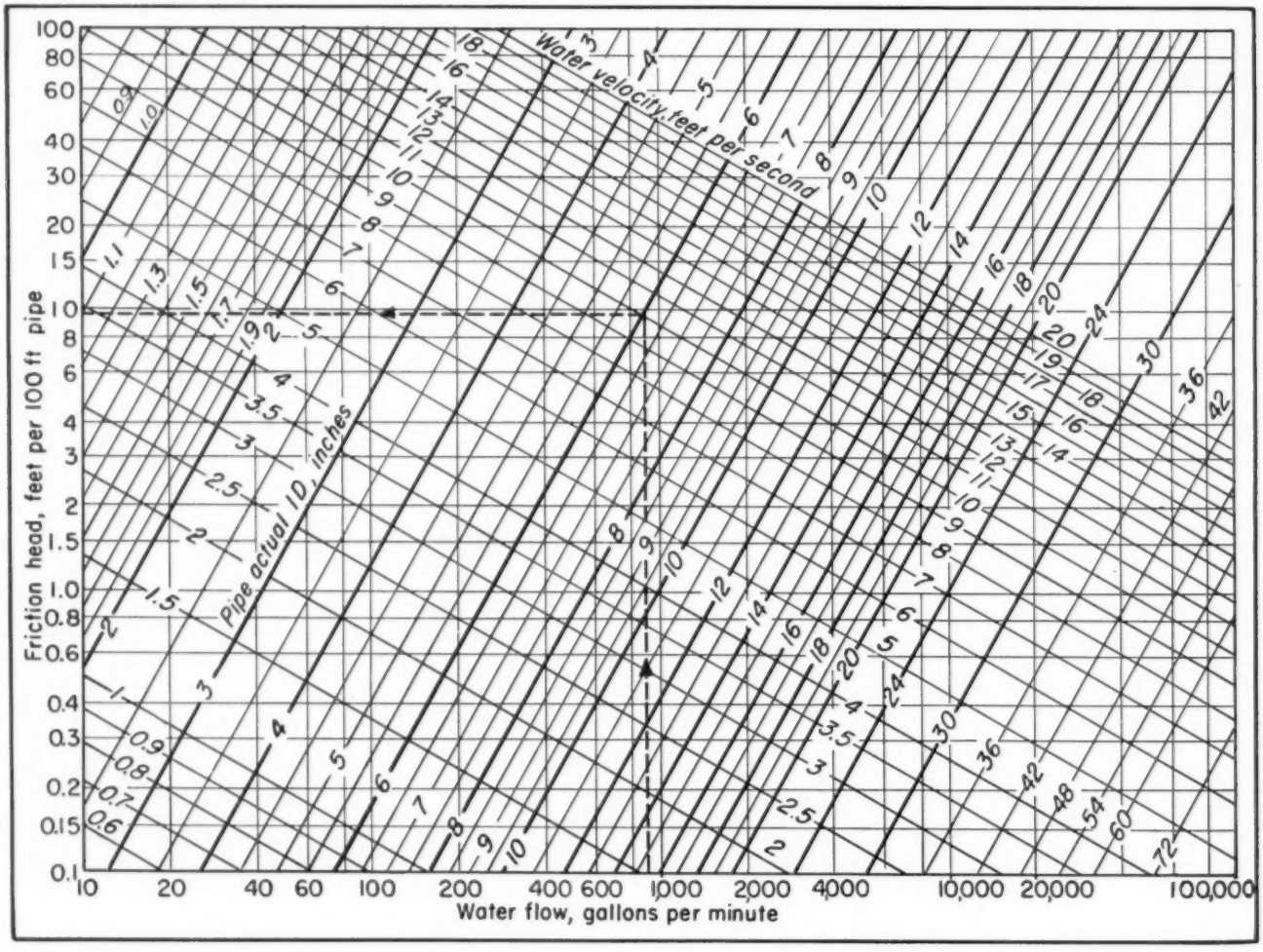
Solution: From a reference table, pipe ID is found to be 6.065 in. Find 900 gpm on bottom of scale chart and trace vertically to diagonal curve at about 6.1-in. pipe ID. At this intersection read from diagonals running at right angles water velocity of 10 fps. On vertical scale read friction loss of 9.6 ft of water per 100-ft pipe length.

Total friction loss = $9.6 \times (435/100) = 41.8$ ft of water.

FRICTION-LOSS MULTIPLYING FACTOR FOR PIPE CONDITION

Condition	Factor
Copper tubing	0.61
Clean new pipe	0.77
Average pipe	1.00
Very old pipe	1.21

* Copyright by the author



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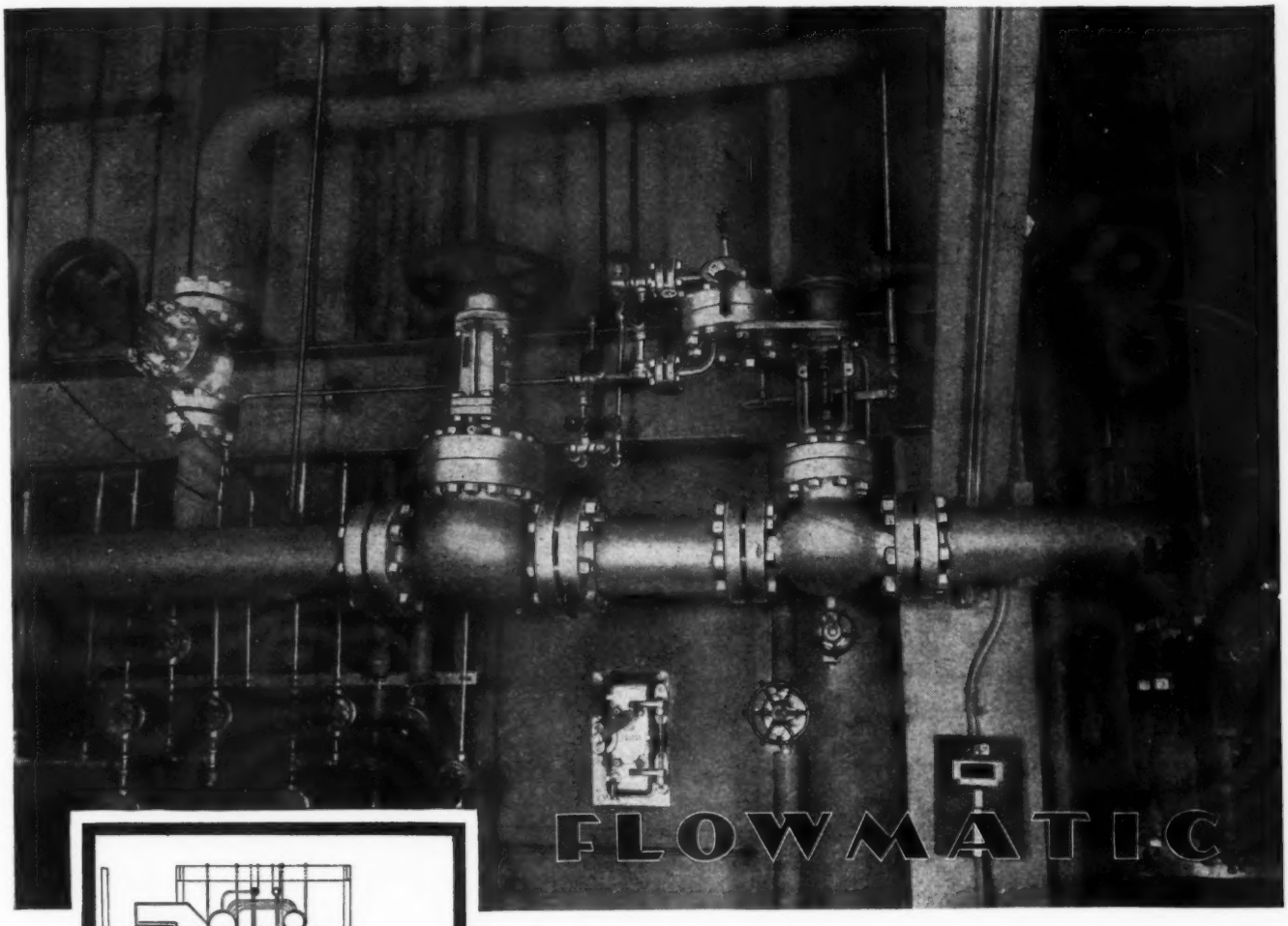
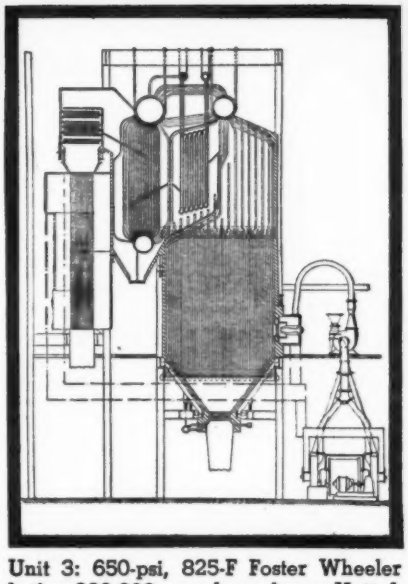




Unit 3: 650-psi, 825-F Foster Wheeler boiler; 220,000 pounds per hour. Units 1 and 2 are similar, with half the capacity.

at Greenidge Station . . .

THIS relay-operated COPES Flowmatic closely stabilizes water level on Boiler 3 at Greenidge Station, New York State Electric & Gas Corporation. Boilers 1 and 2 have COPES simple level control, plus COPES pressure control on the turbine-driven feed pumps. The installation is fully described in Bulletin 463—Boiler Feed Control at Westover, Greenidge and Jennison Stations. Write—your letterhead, please—for this interesting Performance Report.

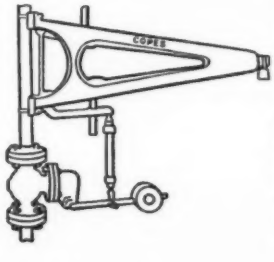
NORTHERN EQUIPMENT COMPANY

571 GROVE DRIVE, ERIE, PENNSYLVANIA

Feed Water Regulators, Pump Governors, Differential Valves, Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS: Canada, England, France · *Representatives Everywhere*

★ GET CLOSER LEVEL CONTROL WITH COPES FLOWMATIC

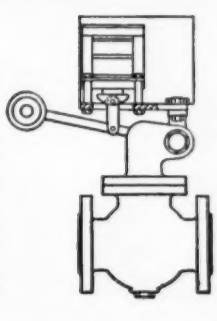


FOR SMALL BOILERS

If you have smaller boilers which carry reasonably constant loads at moderate pressures, you can get all the benefits of continuous feed and stabilized water level from COPES Type OT—a simple level control feed water regulator. Compact, it is easy to install and maintain. A proved performer in hundreds of plants. Write for information.

SOLENOID VALVES

There must be a good reason why important plants have gladly paid a premium for COPES Solenoid Valves. It lies in the sound engineering design, plus the rugged construction which stands up under use and abuse. Not carried in stock, each valve is built for the individual installation. Sizes: ¾ to 6 inch. Write for data.



NEW PROVERBS FOR YOUNG ENGINEERS

GETTING-ALONG SKILLS

Other things being equal, skill with words will add between $20,000 and $100,000 to an engineer's lifetime earnings.

The engineer who is a warm, expressive human being will always stand out in the crowd of overly modest and tongue-tied technologists.

There is neither sense nor profit in talking over people's heads. Plain talk is best, however profound the thought.

When small ideas in big words fail try big ideas in small words.

If you would command attention, understanding and action, write and speak plainly in short words and short sentences.

CLIMBING THE EXECUTIVE LADDER

Number one requirements for any executive are an understanding of people and the ability to select them, direct them and win their loyal cooperation.

Let the man below do everything he can do as well as you at lower salary cost. And remember that power and credit must go with responsibility.

Both fairness and good business demand that you work always for the man who works for you.

If your abilities are not appreciated, don't sulk; get another job. This is a free country.

In general a man is made an executive not because he is outstanding in any respect but because the other candidates are badly lacking in some essential quality.

For success in cooperative ventures associate yourself with men who have the habit of success in all they undertake.

Be polite to all the people you meet as you climb the ladder of success. You may pass some of them again on the way down.

No man will go far who can't perform the impossible now and then when occasion requires.

Despite the old adage, don't be afraid to be a "jack of all trades." The modern world needs more of them to tie together the little cells in which the specialists live. Practical versatility is a rare and valuable quality.

Men are promoted not as a reward for past performance, but in expectation of future performance. Your past work is a sample, not an IOU.

Don't expect high position if you lack the courage to stand on your own feet, take full responsibility, make firm decisions, and face the consequences without flinching.

GETTING STARTED

The new man should not try to impress his fellow workers with the extent of his knowledge. The truth will leak out soon enough.

Never assume that something will get done just because you arranged to have it done. If the matter is important check, recheck, and then check again.

If the facts of business life don't seem to jibe with the theories you have learned, stop and think before you deny the facts.

Because the accuracy and judgment of the young engineer are suspect until proved, check and double check your every proposal and report.

Probably the best advice to the young man just starting engineering life is to make himself generally agreeable, useful and dependable without bootlicking and never, under any circumstances, "high-hat" anybody.

To insure success pick the right boss and proceed to make his life easy.

FOR THE GOOD LIFE

Pick the right wife and learn how to get along with her.

For a full and happy life watch your health, keep peace with your neighbors and your conscience, be a good citizen, do some physical work at home, have some fun too, cultivate a sport or a hobby, sample the best in the fine arts.

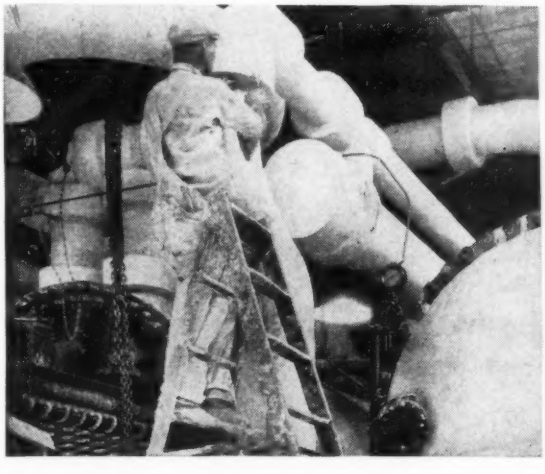
This is the second batch of proverbs by Phil Swain—the first appeared on this page last month. I asked him for permission to print them here because they offer sound advice and guidance for every engineer. The editors of POWER have made reprints for those who would like a few extra copies.

George Edwards
Engineer

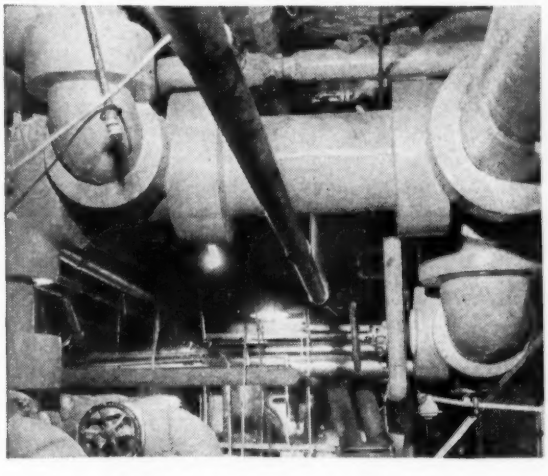
The RIGHT INSULATION, correctly applied, NEVER GROWS OLD

ENGINEERING: In planning your insulation job, first call in an experienced insulation engineer. Johns-Manville . . . Insulation Headquarters for more than 75 years . . . maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job . . . make it "*right* the *first* time."

RIGHT INSULATION: Any insulation will save money—but only the right one will save the most for the longest period of time. Johns-Manville makes a wide range of insulations for every service and temperature. One of them, J-M 85% Magnesia, is the most widely used of all industrial insulating materials.



CORRECT APPLICATION: No insulation is better than the man who installs it. J-M Insulation Applicators are industry's first choice for completely efficient jobs because: (1) They are trained in all phases of insulation application. (2) They employ skilled mechanics and up-to-date application methods.



28 YEARS YOUNG! Back in 1919, J-M 85% Magnesia was installed in the boiler room of the Rice Hotel, Houston . . . engineered right and installed right it is still cutting fuel costs—providing efficient service. Let us help you with your insulation problems. Write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE *First in* INSULATIONS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

Tanker Provides Power On California Coast

► STERN HALF of former Russian turbine-electric tanker, the SS Donbass III, is Pacific Gas and Electric Company's novel solution to postwar shortage of central-station equipment for additional electric power in the Humbolt area of California. Permanently moored at the Eureka waterfront, the 6700-hp General Electric steam-turbine electric marine power plant of the salvaged vessel is supplying electric power to the inland area.

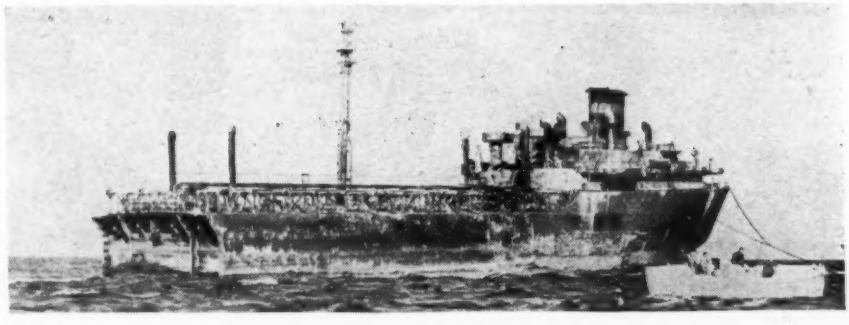
Pacific Gas & Electric recently purchased the aft section of the Donbass from United States Maritime Commission and had it towed from Seattle, Washington, to Eureka, California. General Electric service-shop personnel inspected the entire generation system and fitted the ship for shore service. A bank of transformers have been installed on the dock alongside the salvaged vessel, and feed power directly into a 12-kv transmission line.

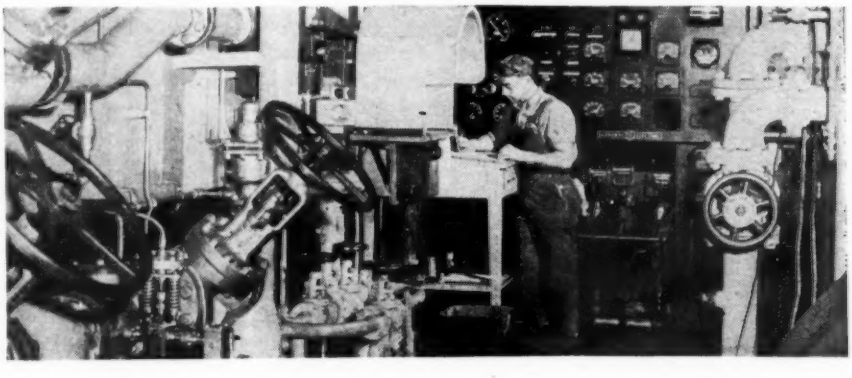
The SS Donbass III, originally SS Beacon Rock, was built in 1944 at Swan Island Shipyards, Portland, Oregon, and was operated under lend-lease by USSR. During the war the Russians hauled aviation gas and other fuels in the tanker and carried deckloads of American-built airplanes and tanks. It ran from the Pacific Coast through the Bering, Okhotak and Japan Seas to Vladivostok.

On February 17, 1946, the SS Donbass broke in two in the Gulf of Alaska, costing the lives of her entire Russian crew. Five days later the SS Puente Hills, a marineship tanker operated by General Steamship Corporation for the War Shipping Administration, sighted the stern half and took it in tow. After battling stormy seas for 21 days, the derelict was towed into Port Angeles, Washington.

The Puente Hills' crew claimed the Donbass as a prize, and their claim was upheld in Federal Court. The prize fund for the salvor's crew and operator was established when the WSA paid $110,000 to repurchase the ship.

(*Continued on page* 176)





Stern half of SS Donbass III, former Russian turbine-electric tanker, in top photo, is being towed to dock at Eureka, Calif. Main control panel in engine room is shown in the lower photo. Meters indicate that the unit is under load

COMING EVENTS

May 21-24—19th Annual Conference, Oil & Gas Power Div, American Society of Mechanical Engineers, Hotel Statler, Cleveland, Ohio. C F Foell, div secretary, c/o Socony-Vacuum Oil Co, 26 Broadway, New York, N. Y.

May 22-31—"The Atom in Peacetime" Exhibit, Public Auditorium, Cleveland, Ohio. John A Crawford, managing director, Mid-America Exposition, Inc, Public Auditorium, Cleveland, Ohio.

June 1-4 — Semiannual Meeting, Hotel del Coronado, Coronado, Calif. Dr B M Woods, president, American Society of Heating and Ventilating Engineers, 51 Madison Ave, New York 10, New York.

June 9-13—Summer Meeting, Mount Royal Hotel, Montreal, Que, Canada. H H Henline, American Institute of Electrical Engineers, 33 W 39th St, New York 18, N. Y.

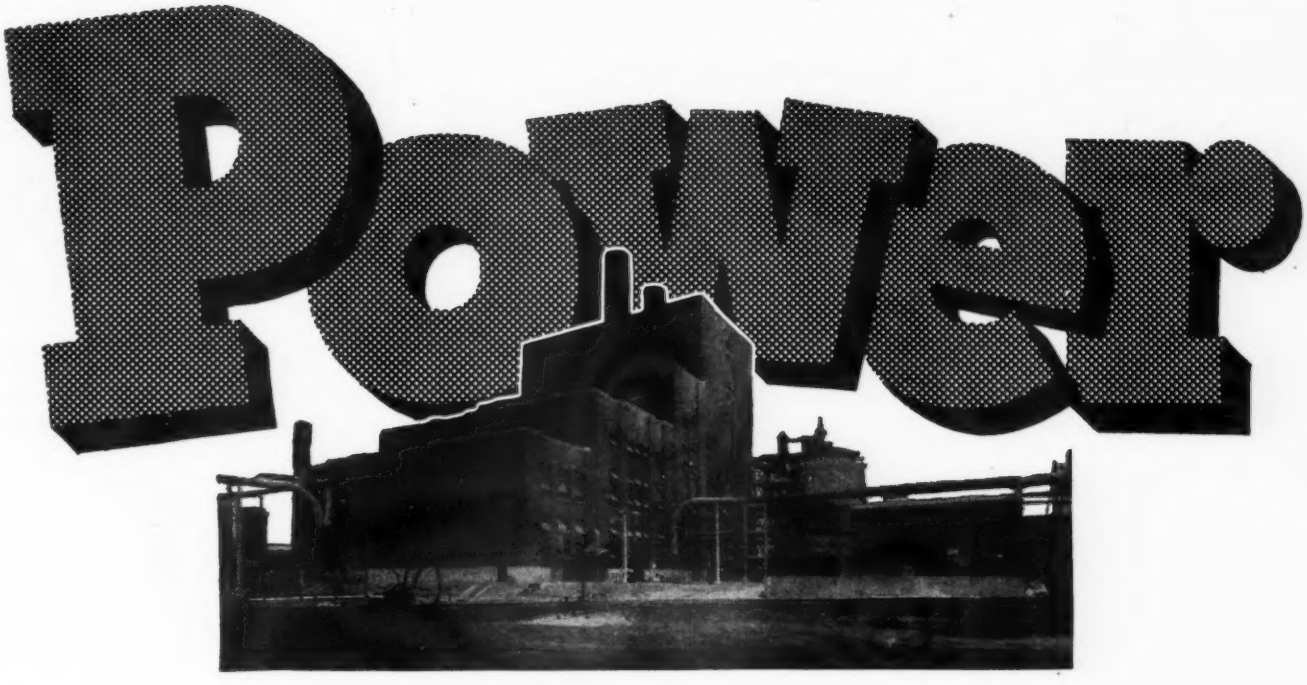
June 15-19—Semiannual Meeting, American Society of Mechanical Engineers, Hotel Stevens, Chicago, Ill. John R Michel, chairman, c/o Commonwealth Edison Co, Chicago.

June 16-18—59th Annual Meeting, French Lick Springs Hotel, French Lick, Ind. A C Baker, secretary, American Boiler Manufacturers Assn, 264 Rockefeller Bldg, Cleveland, Ohio.

June 16-20—11th Prime Mover Control Conference, Woodward Governor Co, Rockford, Ill. Norman Noling, Woodward Governor Co, Rockford, Ill.

June 24-27—38th Annual Meeting, Chalfonte-Haddon Hall Hotel, Atlantic City. Original dates were June 16-19 at Hotel Ambassador. John F Collins Jr, National District Heating Assn, 827 N Euclid Ave, Pittsburgh, Pa.

July 7-9—Annual Meeting, Royal York Hotel, Toronto, Ont., Canada. Columbus D Behan, secretary, Smoke Prevention Assn of America, 159 N Clark St, Chicago, Ill.



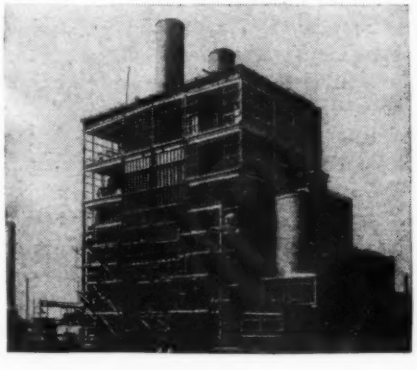
for Petroleum Refining

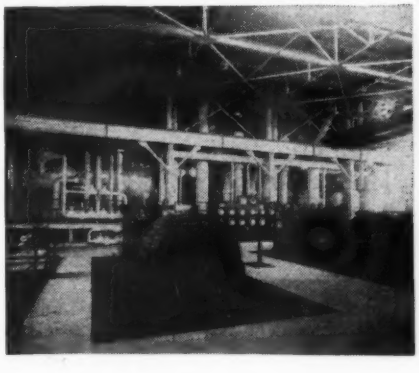
Great refineries of Standard Oil Company of Indiana convert the mid-continent's *black gold* into the myriad products and by-products which power and lubricate the planes, trains, ships, motor cars, production machinery in a large sector of industrial America.

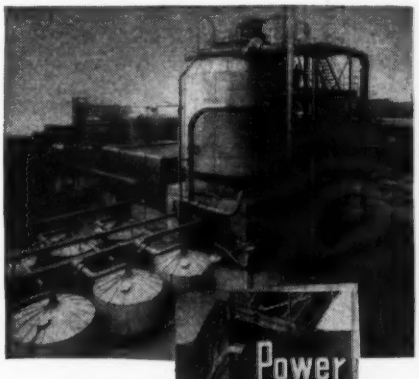
But refineries, too, require power,—electricity, steam, compressed air, liquid pumping. At its huge Wood River, Illinois, refinery Standard Oil Company planned for present and future needs with a modern plant designed to provide all the power services for petroleum processing.

Dravo Corporation Power Plant Specialists accepted complete responsibility for construction of foundations, building, and equipment installation at Wood River; Standard Oil Company Construction Engineers were relieved of details of supervision, building trades coordination, integration of separate items of equipment.

Power and Boiler Plant Specialists at Dravo Corporation have a background of experience which can be of real value to industrial executives and consulting engineers concerned with construction and equipment installations for all types of power and boiler facilities. Further details of this Dravo experience are covered in Bulletin CF-504; Power Department, 300 Penn Avenue, Pittsburgh 22, Pa.







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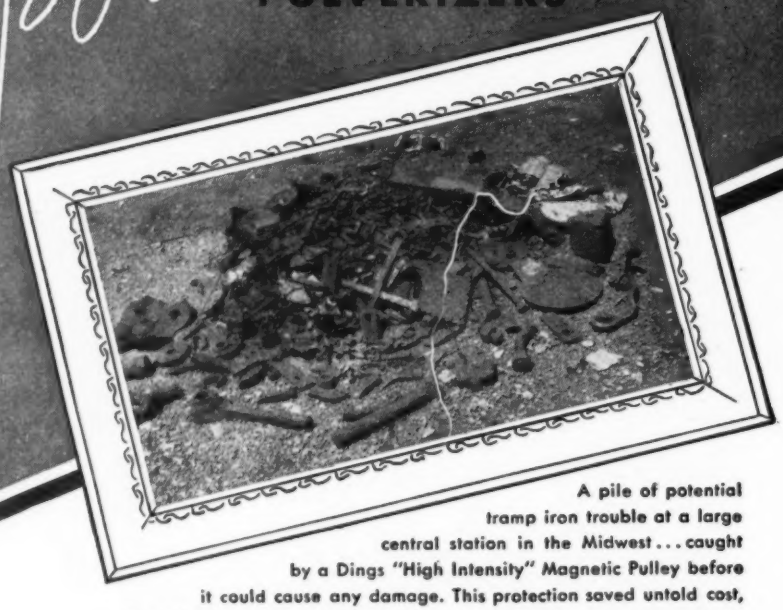
Portrait OF TROUBLE FOR STOKERS OR PULVERIZERS

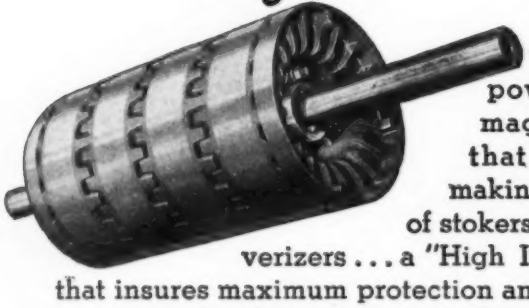


A pile of potential tramp iron trouble at a large central station in the Midwest . . . caught by a Dings "High Intensity" Magnetic Pulley before it could cause any damage. This protection saved untold cost, through reduced equipment maintenance and fewer power outages.

DINGS magnetic pulleys

REMOVE TRAMP IRON

Positively . . . Automatically



• • • Here's the powerful electro-magnetic separator that keeps trouble-making tramp iron out of stokers, grates and pulverizers . . . a "High Intensity" Pulley that insures maximum protection and requires minimum attention. Simple to install as drive pulley on any conveyor belt, economical to operate . . . and *completely automatic!* Get full data today on low-cost tramp iron protection for your plant.

Dings Magnetic Separator Co., 4765 West McGeogh Avenue, Milwaukee 14, Wisconsin.

Dings

"HIGH INTENSITY"

Separation Headquarters Since 1899

Gas Turbines

(*Continued from page* 102)

Emphasis is placed on the experimental nature of the locomotive program. Northrop-Hendy engineers fully realize that adapting an aircraft unit to locomotive service will not produce results equal to those from a design built from the ground up, but they believe this procedure offers the shortest path to experimental data needed for a complete design. While designs are expected eventually to bear a close resemblance to the prototype in many respects, it is likely that individual components will be altered for conditions in railroad service. For example, the present unit burns kerosene or gasoline while ultimate units for railroad or industrial applications would burn heavy fuel oil or, if current research by the Locomotive Development Committee proves successful, pulverized coal.

In the studies leading to adoption of essentially conservative design conditions for the present unit, Northrop-Hendy engineers found that gain in efficiency and capacity, resulting from higher temperature, rarely proves sufficient to offset the increased cost of materials, fabrication and maintenance. They have worked out a design that strikes an economic balance of these factors with a margin of conservatism to insure reliability and long life.

General Electric Program. Alan Howard, turbine-generator design engineer at Schenectady, revealed that the General Electric Co is also concentrating its aircraft gas-turbine facilities for development of these units in the nonaircraft field.

Shop tests of a 4800-hp gas turbine set (see POWER, Oct 1946, p 97) are scheduled to begin this spring. A 5000-kw stationary power plant is in the design stage and will not undergo factory tests until 1948.

Development of large gas turbines began before the war but was sidetracked for development of aircraft power plants, such as the TG-100 and TG-180 powering latest U. S. fighter planes. After the war's end, development of these and other aircraft units was transferred to the Lynn, Mass. Works and gas-turbine developments for stationary, marine and other applications were resumed at Schenectady, incorporating many of the advancements in aircraft turbines.

The 4800-hp gas turbine will burn bunker-C oil although work is being carried on in using pulverized coal. The

"Half-inch or Thirty!"

You don't do much shopping around for the fittings you need when you deal with the Tube Turns distributor. He's got 'em or can get 'em for you, fast—welding elbows ranging in diameter from tiny half-inch to a mighty thirty inches, welding fittings of all types and thicknesses in a wide range of prices.

Tube Turns' complete line of TUBE-TURN welding fittings and flanges in grade A and grade B carbon steels contains more regularly manufactured items than any other line—more than 4,000! And this is supplemented by an extensive selection of items in a wide range of special metals and alloys —stainless steels, carbon moly steels, chrome moly steels, copper, aluminum, brass, monel metal, inconel, nickel, wrought iron.

Write for the name of your nearest Tube Turns distributor, and for facts about how the fittings that become part of the pipe serve others in your industry.

TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY

District Offices at New York, Washington, D. C., Philadelphia, Pittsburgh, Detroit, Chicago, Houston, San Francisco, Los Angeles

TUBE-TURN tt *Welding Fittings and Flanges*

ONE SOURCE OF SUPPLY FOR ALL WELDING FITTING REQUIREMENTS

FULLER
ROTARY
COMPRESSORS

for
SEVERE SERVICE

Fuller Rotaries are built for the hard, severe service all equipment is subjected to today. Thousands of these machines are in service in practically every branch of industry, running 24 hours a day, day in and day out. They're built for just that kind of service ... minimum number of working parts. No valves to leak, no seats to grind, no adjustments or takeup. Of prime importance: *Fullers always maintain original capacity for the life of the machine.*

Get acquainted with Fuller Rotaries ... Send for Bulletin 5-C.

FULLER COMPANY, CATASAUQUA, PA.
Chicago 3 - 120 So. LaSalle St.
San Francisco 4 - 421 Chancery Bldg.

C-149

FULLER
A LIFETIME OF NEW MACHINE EFFICIENCY

unit now under construction is about 19 ft long and weighs between 2½ and 4 lb per hp.

It is felt the 5000-kw plant will be competitive in over-all economy with other plant types of equal capacity. In this plant, which burns oil, air flows through two stages of compression with intercooling, a regenerator and then into six combustion chambers. From here 1500-F gas expands through a 2-stage turbine that drives the high-pressure compressor at 8700 rpm. Rest of the expansion takes place in a single-stage low-pressure turbine that drives the low-pressure compressor.

This spring the General Electric Co will have facilities in operation for large-scale testing of pulverized-coal firing in gas turbines. Full-scale testing with heavy fuel oil has been under way for some time. While the gas turbine appears very promising, Howard stresses the fact it is still in the development stage.

Make Tanks Safe

(*Continued from page* 91)

purpose as it has no moving parts and is not apt to produce a spark. Fed by compressed air at 50 to 100 psi, the device induces the flow of eight to 18 times as much atmospheric air; in other words, each cfm of input delivers nine to 19 cfm to the tank. At 90 psi the air mover delivers over 3000 cfm.

If the tank has two manholes or other large openings, fresh air may be forced in at one opening and vented from the other. If there is only one manhole, position the air mover within the opening so exhaust air will vent from the same opening.

Masks and Lighting. If it is impracticable to purge and ventilate a vessel as described, equip each workman with a fresh-air hose mask. Regardless of whether the tank contained dangerous gas or vapor it may be deficient in oxygen so don't use a canister mask. Also, equip each man with a life belt, and place one man in constant attendance at the life lines outside the manhole.

Tank cleaning and repair jobs should be done during the daylight hours if possible. For illumination place high-power floodlights outside the manhole and direct the beams into the opening. Or use a 3-wire extension cord with the lamp protected by a vaporproof globe and heavy wire guard, provided

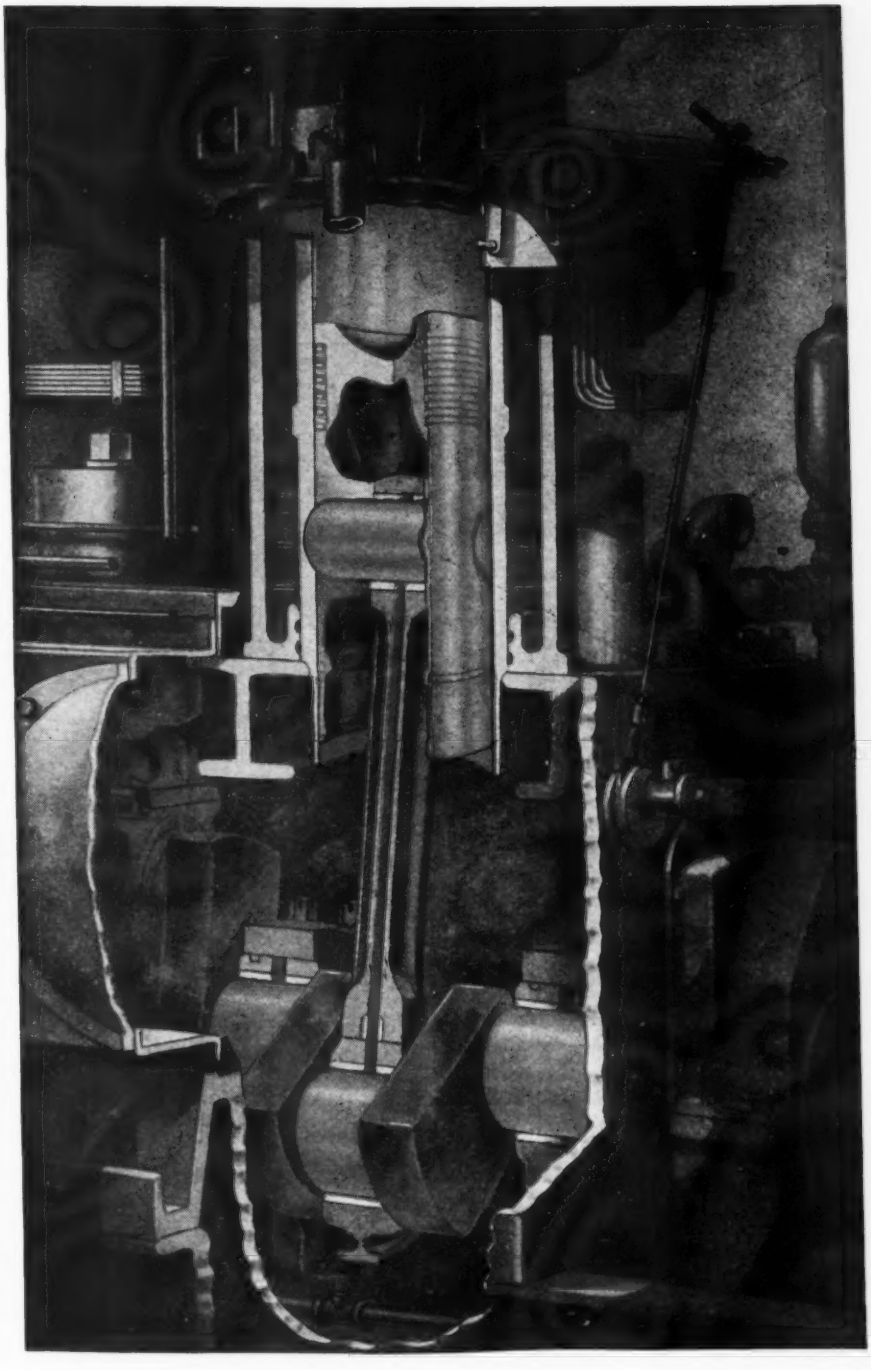
Inside Knowledge on Lubrication Problems

— CRANKCASE DEPOSITS —

This is One of a Series of Messages on Common Problems in Your Plant

Battle-Ground

FOR OIL AND HOT AIR!



IN THE CRANKCASE of your Diesel engine, conditions are "made to order" for the formation of objectionable sludge and clogging deposits.

Thrown from the crankshaft and connecting rod bearings, a spray or mist of oil is constantly churned in a hot atmosphere of air, water vapor and combustion gases. This exposes the oil to extremely severe oxidizing conditions, tending to form sludge and deposits.

Gargoyle D. T. E. Oils have been specially developed to meet these conditions. They have unusual stability and resistance to oxidation. Crankcases stay clean; the danger of clogged oil passages is minimized. The original rich lubricating quality of the oil is maintained for long periods, to give maximum protection against wear.

The same oils also possess the special qualities which minimize the formation of gum and hard carbon in the ring zone—keep engines operating at top efficiency.

GARGOYLE Lubricants

SOCONY-VACUUM

SOCONY-VACUUM OIL CO., INC.
and Affiliates: Magnolia Petroleum Company
General Petroleum Corporation

Socony-Vacuum Correct Lubrication

FOR EVERY MACHINE . . . EVERY OPERATING CONDITION

—and you take a direct route to stepped-up boiler performance, for APEXIOR-coated tube and drum interiors give lasting new-metal service.

APEXIOR NUMBER 1 isolates steel from steam and water contact — permanently stabilizes boiler metal at new or newly cleaned efficiency beneath a surface that's insoluble in any boiler water.

Brush-applied to drums by hand, and to tubes by powercoater, APEXIOR holds the line against operating variables . . . adds a factor of security, for an APEXIORized boiler is corrosion-proof and deposit-resistant — economical to maintain because it stays insulation-free for better heat transfer, longer in-service time, less man-hour cost for cleaning.

Before you order a new boiler, or take an old one off the line, let us tell you more about APEXIORized metal. Write us at 1246 River Street, Hyde Park, Boston 36.

THE DAMPNEY COMPANY OF AMERICA
HYDE PARK, BOSTON 36, MASSACHUSETTS

APEXIOR

43-1-1

the cord is in good condition and the lamp guard properly grounded. The cord must be continuous inside the tank; that is, plugs and receptacles must be outside.

Fill With Water. If necessary to weld a small vessel, such as a gasoline tank or drum, it may be more convenient to fill the vessel with water to a line just below the spot to be welded; then create an inert atmosphere above the water. Do this by dropping chunks of dry ice into the water. As they melt, CO_2 collects in the pocket.

When the inspection or repair job has been completed, and the vessel is again to be filled with a flammable liquid or gas, the air must be purged from the tank before the hazardous fluid is admitted. Otherwise, as the tank fills there will be a time when an explosive atmosphere exists. Remember that refilling a tank may be almost as hazardous as purging it for inspection.

In some jobs some of these recommendations will be impracticable; the person in charge will then have to use his best judgment. As a matter of fact, there is no substitute for good judgment even when rules are being followed conscientiously.

Reader's Problems

(*Continued from page* 117)

"picking up" of copper by the brushes. Composition of the ring metal is such that it offers a certain resistance to free movement of the brushes over the surface under given conditions. His brush angle should be correct. He should not assume it is, but should check.

To correct the condition *CLC* should put into use a set of graphite brushes of proper carrying capacity. After a couple of days' use, a good set generally corrects the squealing.

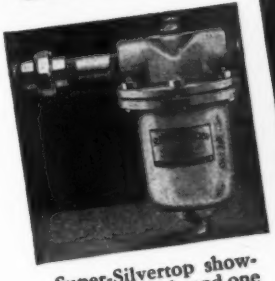
Shiprock, N. Mex. J F MAHER

Try a Little Kerosene

SOME YEARS AGO we had a unit like *CLC's* that squealed when starting or when the load became heavy. As *CLC* mentioned, there was apparently nothing wrong with the converter. We concluded that squealing was due to the drying out of the brushes from the warm slipring when the generator was stopped. This, of course, caused the brushes to be dry when the rotor

We can save six scarce fittings per trap by using SUPER-SILVERTOPS

and here's how



Super-Silvertop showing one nipple and one union needed.

Conventional trap using seven fittings and two unions.

NOW—with pipe fittings so hard to get—saving of fittings is more important than ever. Dollar-wise, the saving on installation labor is greater, but today, fittings are so scarce that they are worth much more than their cost. Anderson Super-Silvertops save those fittings by incorporating the U-tube right in the trap. All pipe connections are in the head of the trap, with provision for either elbow or straight-through piping.

The difference between Super-Silvertop simplified piping and wasteful confusion-piping, with conventional inverted bucket traps, is clearly shown in the two photos above. The savings with Super-Silvertop are yours throughout the size range, including the steel series traps for higher pressures. Do you want to make these savings? Then, send today for full details given in the book, "How to Choose A Steam Trap". This helpful free volume points the way to simplified piping and lower trapping costs.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland 2, Ohio

SUPER-SILVERTOP STEAM TRAPS

BELMONT

FLAX PACKINGS

Outstanding in Quality and Uniformity

CAREFUL selection of raw flax and the control of various processes of hackling, spreading and drawing to provide suitable rovings for braiding and finishing . . . are responsible for the consistent high quality of Belmont Flax Packings.

BELMONT 401X (Coil or Reel) — Best quality Line Flax Fibre of selected length and strength.

BELMONT 404 (Coil) — Pure flax fibre of next fibre length to Line Flax.

BELMONT 303 (Coil) — Line Flax of selected quality, with coarse and short fibres extracted. Treated with waterproof lubricant, and surface graphited.

Just as Belmont Packings are uniform in quality, so are they, wherever practicable, uniformly packed in attractive and secure boxes bearing our orange colored trade-mark on a blue background.

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

And . . . you can get Belmont Packings locally — distributors are located in every large industrial center, ready to serve.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY
BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

started. When it had run a short period the squeaking usually stopped. Evidently the binder or adhesive that holds the graphite brushes together contains some oily substance which, when slightly warm, lubricates them. The brushes also squeaked if the load became excessively heavy.

Squealing was overcome by touching each slipring with a rag dampened with kerosene. Or a very small oil can could be used to drop one or two drops of kerosene on each slipring. We believe that sliprings became warm as did the brushes when the load became heavy. This caused the natural oil in the brush to become heated, especially at the point of contact, so that squeaking was set up. Usually cure was not permanent if the overload continued because in two or three hours the brushes would again dry out and kerosene had to be used again. Too much kerosene would tend to soften the brushes. But small amounts overcome the difficulty and brushes do not show excessive wear.

L D KLOPFENSTEIN
Harvey, N. Dak.

Recommends Softer Brush

I SUGGEST THAT *CLC* have the sliprings polished with a fine emery cloth. If possible, try putting brushes on a slight angle. Set them so rotation of sliprings is in direction of angle of brushes. They must not fit sloppily in holders. To lubricate sliprings put a few drops of mineral oil on a clean rag and wipe them. Do this several times a week; also use softer brushes.

Oaklyn, N. J. S W WILKES

Use Copper Brushes

SQUEALING AND CHATTERING of brushes on sliprings of synchronous converters are caused either by an insufficient amount of electric current passing through the contacting surfaces, or by interruptions in the current flow, caused by unevenness of slipring. In the latter case sparking also occurs, and usually the slipring becomes pitted.

Since *CLC's* machine neither sparks nor shows pitting, we are safe in assuming the trouble results from insufficient flow of electricity at contact point of brushes to sliprings. This is confirmed by the fact that the trouble is experienced at starting and also when the machine is overloaded.

Assuming that wires are of a size sufficient to carry the current required, the obstacle to the passage of current must be in the brushes themselves. Car-

NOW! QUICK DELIVERY

On Small TURBINE DRIVES*

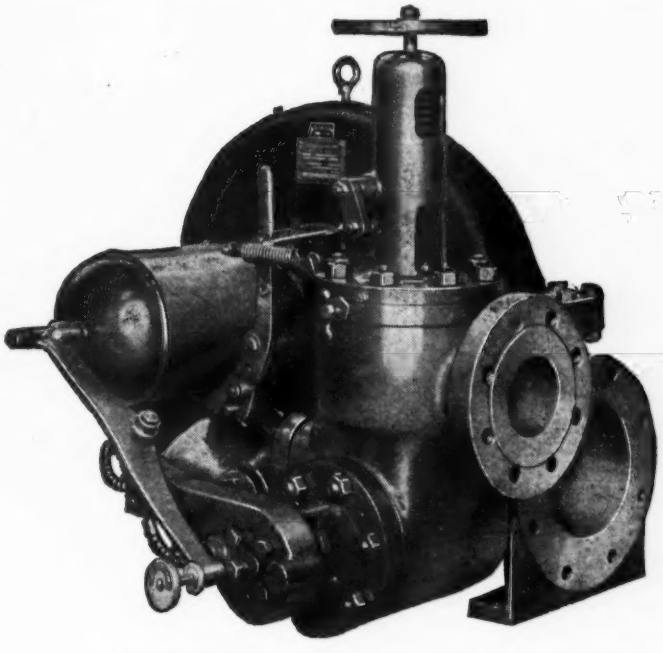
Yes, we mean it! Now you can get standard (single-stage, shaft-governed) turbines in a hurry—average delivery time is *15 weeks* from receipt of order and complete application information. If you have an urgent replacement problem we'll do better than that. In some emergencies, shipment has been made in less than half average time.

STANDARDIZATION DOES IT—Behind this drastic reduction in manufacturing time are two major factors: a new turbine plant now geared up for full production, and standardization of design. This standardization (on single-stage, shaft-governed turbines) has eliminated special calculations and drafting, has streamlined factory operations, and made possible the stocking of practically all component parts.

YOU GET THESE FEATURES—G-E turbines for mechanical drives are made with the same precision and attention to detail used in the building of large turbines for power generation. For example:

- to prevent steam leaks without use of sealing compound, casings are given extra-smooth machine finishing.
- the built-in trip valve is provided with alloy seat and trim to resist corrosion and erosion.
- horizontally split packing assemblies permit quick inspection and removal of packings.
- completed turbines are tested thoroughly at the factory—your assurance that they will be ready to start work when installed.

AT YOUR SERVICE—Our turbine specialists are ready to assist you in the selection of a turbine drive, and are in position to give you fast shipment on standard designs. Call or wire the nearest G-E Sales Office, or write Apparatus Department, General Electric Company, Schenectady 5, N. Y.



*STANDARD (single-stage, shaft-governed) mechanical-drive turbines.

Standard turbines are applicable, in general, for ratings up to 800 hp. The shaft governor used on standard turbines has a regulation of 8 per cent and a speed adjustment range of 1.1 to 1.

The standard units are part of a complete line of G-E turbines, covering a full range of horsepower ratings and a wide variety of steam and speed conditions. Characteristics of governor types available (in addition to the standard shaft governor) are as follows:

OIL GOVERNOR
Regulation: 8%
Range of adjustment: 3 to 1

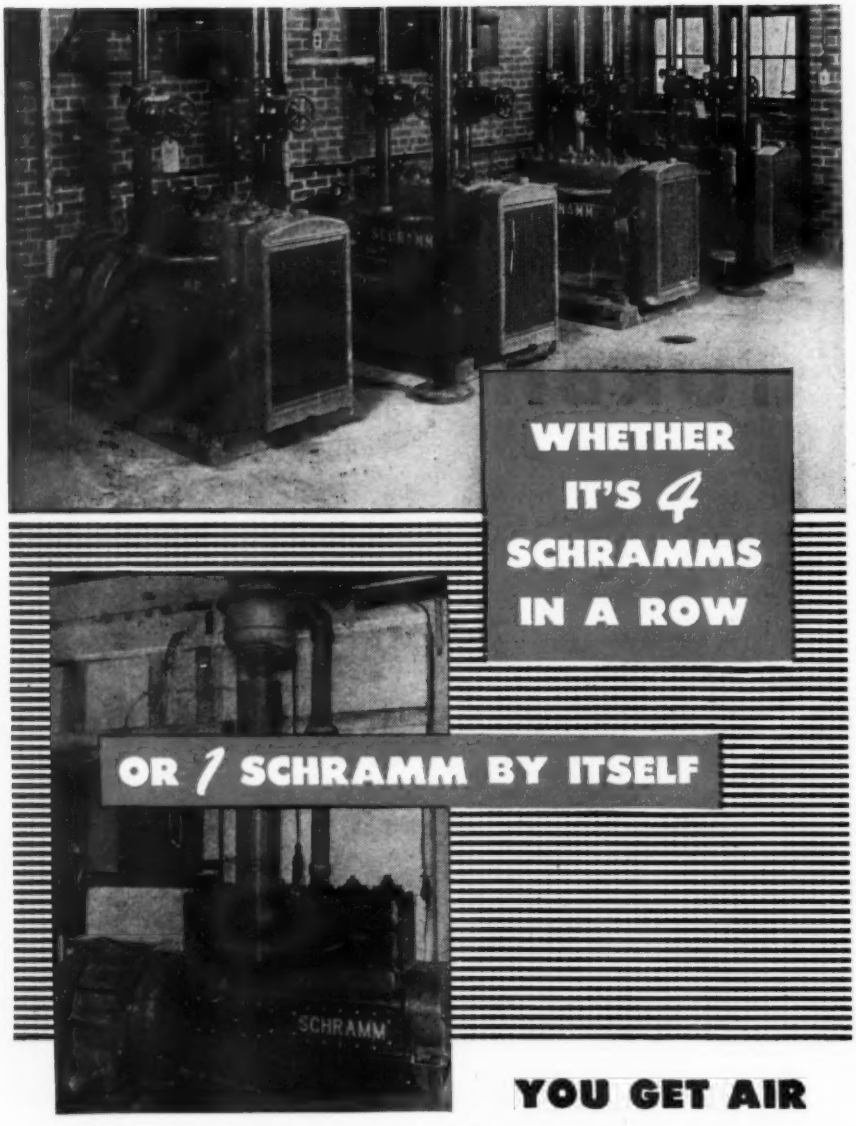
OIL RELAYED-GOVERNOR
Regulation: 4%
Range of adjustment: 8 to 1

ELECTRIC GOVERNOR
Regulation: 0.5%
Range of adjustment: 30 to 1

The extremely fast delivery of 15 weeks applies to the standard (shaft-governed) units only. Delivery time of other units is longer depending upon engineering and manufacturing requirements.

GENERAL ELECTRIC

165-17



YOU GET AIR ECONOMICALLY IN YOUR PLANT *anywhere*

Schramm Air Compressors can be easily installed as a unit system in plants requiring varying compressor loads and Schramm's Automatic Control makes it possible to operate them singly or in units as varying air requirements demand.

Schramm features are distinct: 100% water cooled . . . Forced feed lubrication . . . Mechanical intake valve . . . lightweight, compact, *vibrationless*. There are many compressed air jobs in plants that are ably done by Schramm.

Stationary Schramm Compressors range in size from 2 to 600 cu. ft. displacement. For construction jobs around your plant there are portable units. Regardless of your compressed air need, there is a Schramm Air Compressor available to do the work.

Write us today for complete literature.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

bon brushes are known offenders in this respect. I suggest that *CLC* replace the brushes with copper ones of the same size, and that the machine be brought up to synchronous speed before the load is thrown on.

Paterson, N. J. F M GIORDANO

Outdoor Plants

(*Continued from page 77*)

dropping full load. The small crew was able to handle the station satisfactorily. It is not planned to increase this crew with the addition of the second unit.

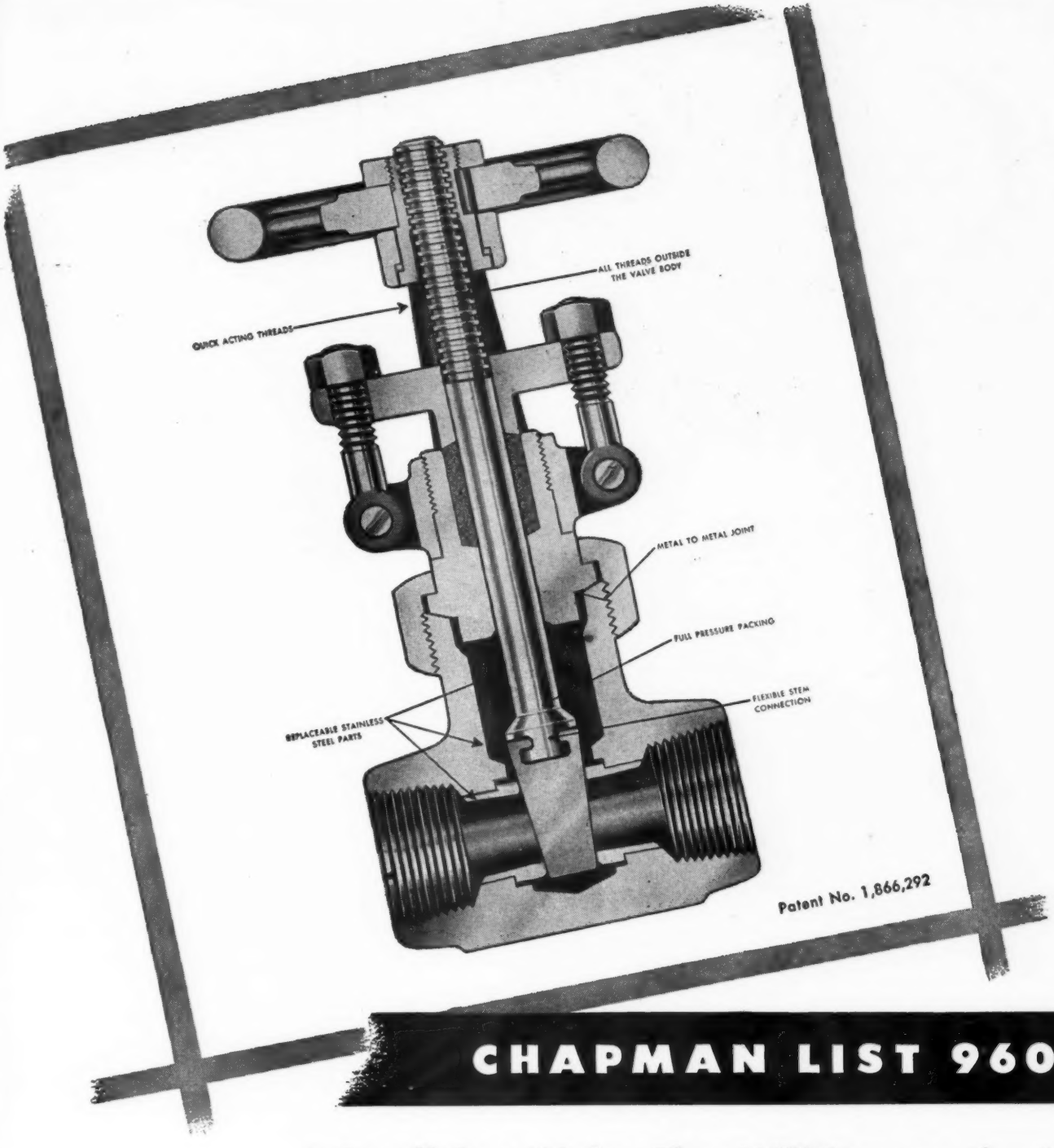
Availability of the two plants was satisfactory as shown in the following:

Year	Unit Availability, Percent West Junction	Gable Street
1939	....	65.3
1940	....	89.1
1941	....	95.5
1942	....	94.3
1943	76.7	91.1
1944	89.5	99.2
1945	96.5	92.3
1946	92.4	95.5

Both of these plants consist of a single boiler feeding a single turbine.

F S Clark. The only excuse for placing equipment outdoors is to save investment. To show the potentialities of such savings, Table 1 lists 17 stations and indicates the proportion of total station investment needed for buildings. They range in capacity from 12,000 to 200,000 kw and individual turbines from 4000 to 100,000 kw. Seven are stoker fired; four burn pulverized coal; one pulverized coal and oil; four gas and oil; and one station burns oil only.

On the average about 20% of plant cost represents building structures. Ratio of superstructure to substructure costs varies widely. For Edgar, superstructure cost was about 90% of the total, while for Norfolk it was 60%. It is not possible to save all of this since some foundations and supporting steel must be provided anyway. A recent estimate showed a power station building cost of $800,000, which could be reduced $100,000 by eliminating the boiler housing. This represented about 2.5% of the station total cost. It is guessed that leaving the turbines unhoused would save about 3% of total cost. These savings are gross since outdoor equipment requires extra investment to provide weatherproofing features.



CHAPMAN LIST 960

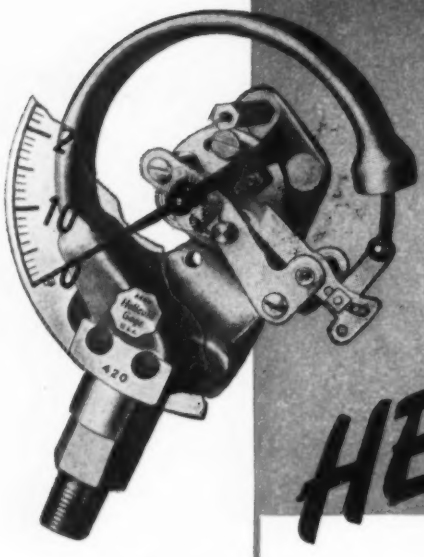
A Small Gate Valve That Will Stay on the Job

Here is a compact forged steel gate valve so ruggedly built that it practically eliminates the maintenance and replacement problem. Because no pressure is transmitted to the stem, it can be repacked under full pressure. Its quick-acting threads will not stick or freeze. It is supplied with super-hardened seats and plugs for extra severe services.

•

Made in sizes from ¼" to 2"— carbon steel for pressures to 800 pounds; alloy steels for pressures to 1000 pounds at 750° F. For higher pressures, specify List 990.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

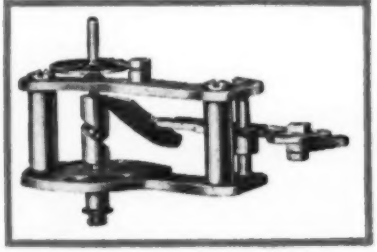


Another FIRST for HELICOID!

Now Helicoid offers pressure gages with Monel Bourdon tubes.

This is just one more advantage of Helicoid Gages: Here are some of the others:

- The Helicoid Movement, which eliminates "clock gears."
- Korex Bourdon tubes of alloy steel, stainless steel or Monel with smooth inside surface less likely to fracture.
- Fused joints for added strength where it's needed most.
- Silver brazed joints in bronze-tube models for the same reason.
- Bronze tubes of heat-treated, phosphor-bronze with silver brazed joints. (Bronze tubing costs about twice as much as brass, but has better spring characteristics.)
- Socket streamlined for easier cleaning and more equalized stress.
- Weather-proof case to keep out dust and moisture.
- These are just a few of the many reasons why large users of pressure gages are standardizing on Helicoid. Write for our technical catalog which tells the complete story.



The Helicoid Movement is one of many exclusive features of the Helicoid Pressure Gage.

ACCO

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

TRADE MARK

Midwest Conference

(*Continued from page 84*)

persons connected with the burning of fuels and to license those responsible for firing all but residential boilers. After summarizing the requirements for successful operation of a pollution-reduction program, he pointed out some of the engineering factors involved: furnace and grate proportions, cinder collection and reinjection, flyash hoppers, disposal of dust from collectors, overfire-air jets, meters and controls, smoke indicators.

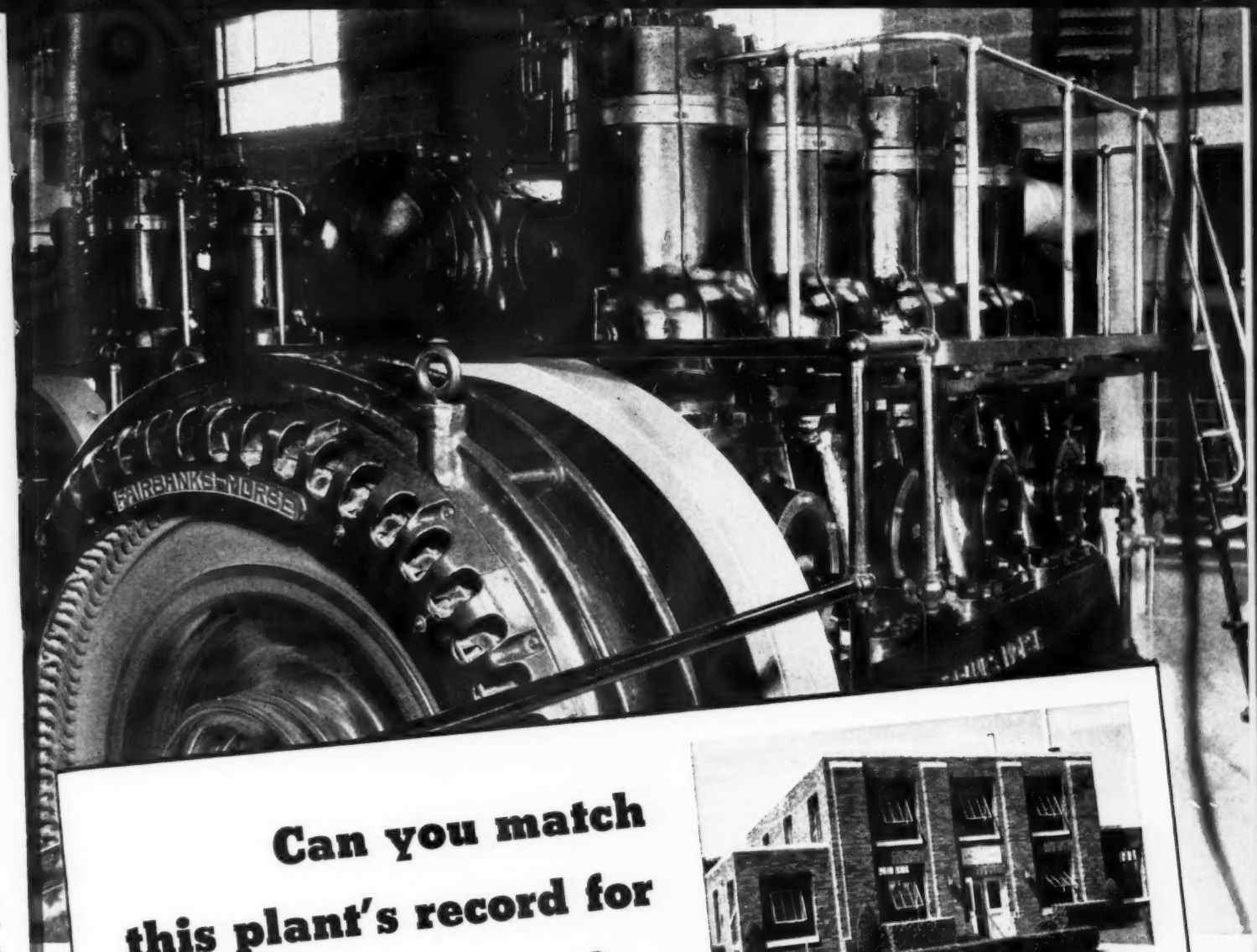
"Industrial-Plant Power Distribution System," by C W Wright, General Motors Corp, described the steps to prepare a plant for increased production. A Delco Products plant at Dayton, Ohio, revamped the entire primary and secondary distribution. All transformers and switchgear are key interlocked to prevent property damage and personal injury from improper switching.

Feed Water. The session on feedwater treatment, under the chairmanship of L G Miller, Michigan State College, included two papers, "The Removal of Carbon Dioxide From Alkaline Waters," by A E Kittredge, Cochrane Corp, and "Demineralized Water—The Process, Application and Results," by L B Porter, Illinois Water Treatment Co.

Feed Pumps. Feedwater treatment aims to supply the best water for boiler conditions with little regard for pumps and valves, declared H L Ross of Allis-Chalmers, in his paper on "Materials as a Consideration in Modern Boiler Feed-Pump Construction." Listing causes of corrosion-erosion in pumps, he said that higher pH values mean less trouble with carbon-steel parts. Preventing trouble on new pumps depends principally on selecting materials to stand any normal feedwater conditions.

Space Heating. Three papers slanted toward home heating offered much of interest to power engineers. R A Budenholzer, of Armour Research Foundation, reported favorably on tests of house heating by reversed cycle refrigeration (heat pump) drawing its low-temperature heat supply from the earth through buried pipe coil. Studies made for the Terra-Temp Co of Indianapolis showed that a reasonable length of ¾-in. OD, or larger, coil buried two or three feet below the average frost line will serve. Heat is drawn from the ground in winter heating and delivered to the ground when the system is reversed for summer cooling.

Budenholzer indicated that electricity would have to sell for 0.85 to 1.5 cents



Can you match this plant's record for low cylinder wear?

Three Diesels in the municipal power plant at the city of Washington, Kansas, are lubricated with Nonpareil HD Diesel Oil. In addition to the fine record on wear cited here, all engines are remarkably clean with no crankcase deposits and exhaust port carbon negligible.

In 1937 a 150 h.p. and a 300 h.p. Fairbanks-Morse Diesel in the Washington, Kansas, municipal plant were started on Nonpareil Diesel Oil. When Nonpareil HD was developed five years ago, it was placed in these engines. A recent inspection of the 300 h.p. Diesel after 37,800 hours, covering the full nine years of operation, reveals that the greatest wear on any cylinder is .0085 of an inch. This is less than one-fourth of the wear normally expected in Diesel operation. Today, in addition to this fine wear record, there are no crankcase deposits—exhaust port carbon is negligible.

As more and more Diesel plants pile up hours of operation on Nonpareil HD, records of unusually low wear and low maintenance costs continue to multiply. The Standard Oil Lubrication Engineer in your locality can give you other examples, perhaps in plants near yours, where Nonpareil HD Diesel Oil is duplicating this high performance record.

If you are located in the Middle West, call or write the nearest Standard Oil Company (Indiana) office. Ask to have the Lubrication Engineer give you all the facts about Nonpareil HD Diesel Oil. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL HD
DIESEL OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

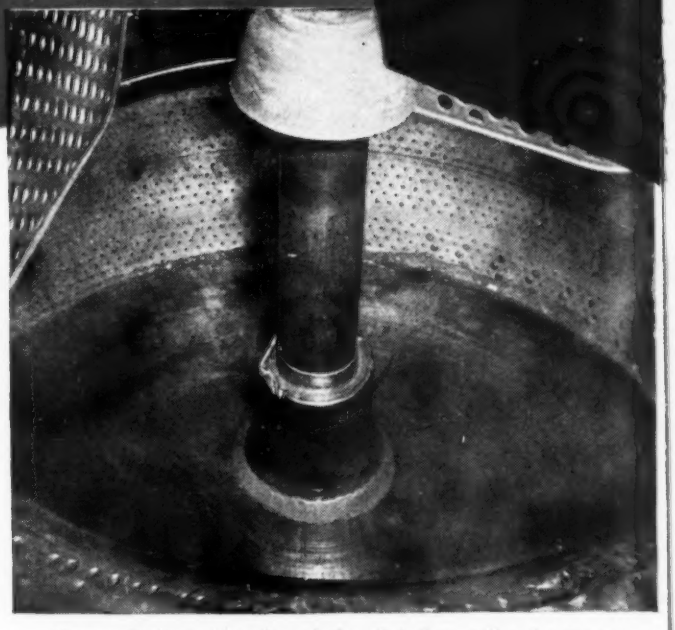
NOW ½ the oil lasts 4 times as long...

with STANODRIP

DO YOU REALIZE what a fertile field plant lubrication offers for cutting corners of costs—in labor, lubricants and maintenance? Economies that are often totally unexpected can be found by a Standard Oil Lubrication Engineer. For example—

A Standard Oil Lubrication Engineer, investigating a minor lubricating problem in a huge laundry, suggested a complete lubrication survey of the plant. He found that an oiler was lubricating centrifugal extractor bearings every hour. Six barrels of oil were needed yearly for three extractors. He recommended Stanodrip. Because of its non-leaking, better lubricating quality, oiling periods were extended to 4 hours. At the end of a year it was found that a 50% saving of lubricant had been secured.

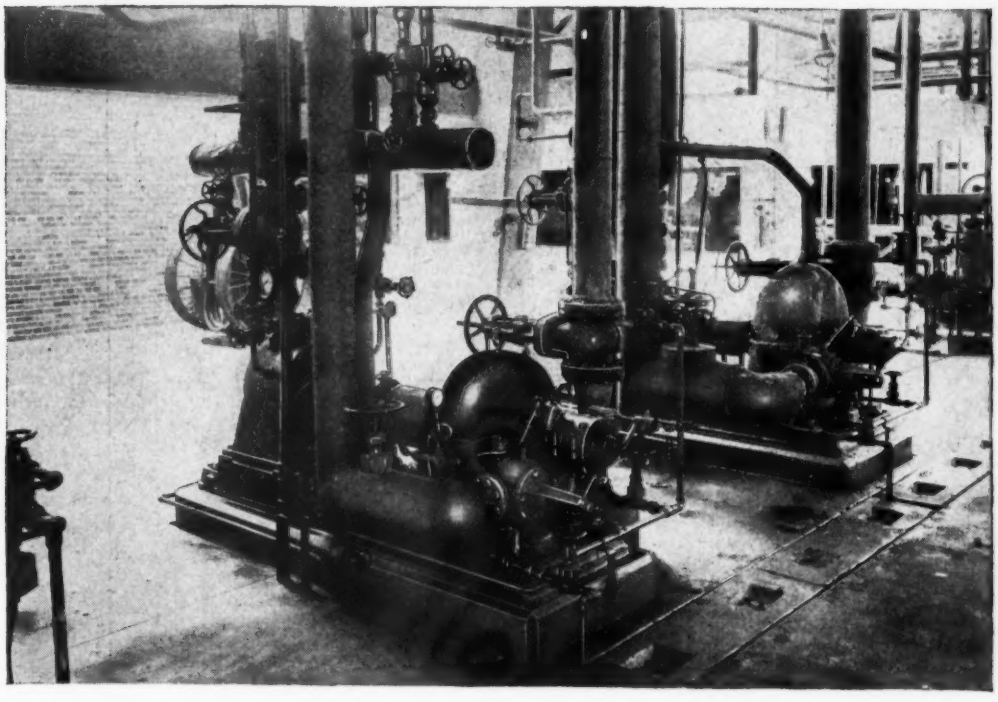
If you'd like to have one of these Lubrication Engineers uncover possible savings like this, ask to have a survey made in your plant. It costs nothing but a phone call to the nearest Standard Oil Company (Indiana) office or a card to 910 South Michigan Ave., Chicago 80, Illinois.



Above—Shaft and bearing of the 60 inch centrifugal extractor pictured below, on which Stanodrip cut lubricant consumption in half and application time one fourth—a typical example of savings that may be uncovered by a Standard Oil Lubrication Survey.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

TERRY



THE ROTORS OF THESE 75 H. P. TERRY TURBINES ARE DOUBLE RIM PROTECTED

The two 75 H.P. Terry Turbines shown above (in the plant of a leading refiner) employ the Terry Solid Wheel Rotor. The wheel is made from a single steel forging and the buckets are milled directly into the wheel. — All as shown in the illustration at the left.

The buckets are protected by rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the clearance became reduced.

With this construction it is impossible for the blades to foul and frequent inspections of the thrust bearing are not required to obtain safe and dependable operation.

This feature and many others of the Terry Wheel Turbine are fully discussed in our Bulletin S-116.

T-1169

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

PUT STEAM
FULLY TO WORK

...By-Product Power

THE ENGINE PAYS
FOR ITSELF AFTER A
FEW MONTHS ON THE JOB!

If you use steam for heating or processing you can probably cut power costs by installing a Troy-Engberg Steam Engine and using By-Product Power to drive stokers, generators, compressors, pumps or blowers.

With proper plant heat balance you use steam direct from the boiler to run the engine and THEN introduce the exhaust into your processing or heating. The engine acts as a reducing valve, producing POWER at the same time. It's By-Product Power. It's exceptionally cheap power.

Consult our engineers about saving with By-Product Power.

TROY ENGINE & MACHINE COMPANY
Established 1870
2523 Railroad Avenue Troy, Pennsylvania

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

per kwhr to compete with coal, oil or gas, noting that the heat pump offers complete cleanliness and summer cooling.

H F Randolph, vice-president of International Heater Co, Utica, N. Y., recommended room heating by hot air passing in a closed circuit through ceiling panels of ordinary lath and plaster. W S Harris, ME department, University of Illinois, gave data on room heating by low-cost inconspicuous baseboard radiators resembling ordinary wood baseboard. With forced circulation of hot water the heating effect approaches full panel heating at lower installation cost.

Air Conditioning. Discussing postwar air conditioning advances, John Hertzler, vice-president of York Corporation, predicted increased use of electrostatic (Precipitron) dust precipitation, odor-removal equipment, germicidal treatment by ultraviolet lamps, heat pumps and radiant heating, combined with air conditioning.

A B Newton, chief engineer, Airtemp Division, Chrysler Corp, noted a continued trend toward hermetically sealed motor-refrigerating compressor combinations in sizes as large as 20 hp.

Walker L Cisler was awarded legion of merit by Col A Riani, U. S. Engineer Corps. Cisler is now chief engineer of power plants of Detroit Edison Co. The award was made for his work in helping restore utility service to damaged areas in European theater.

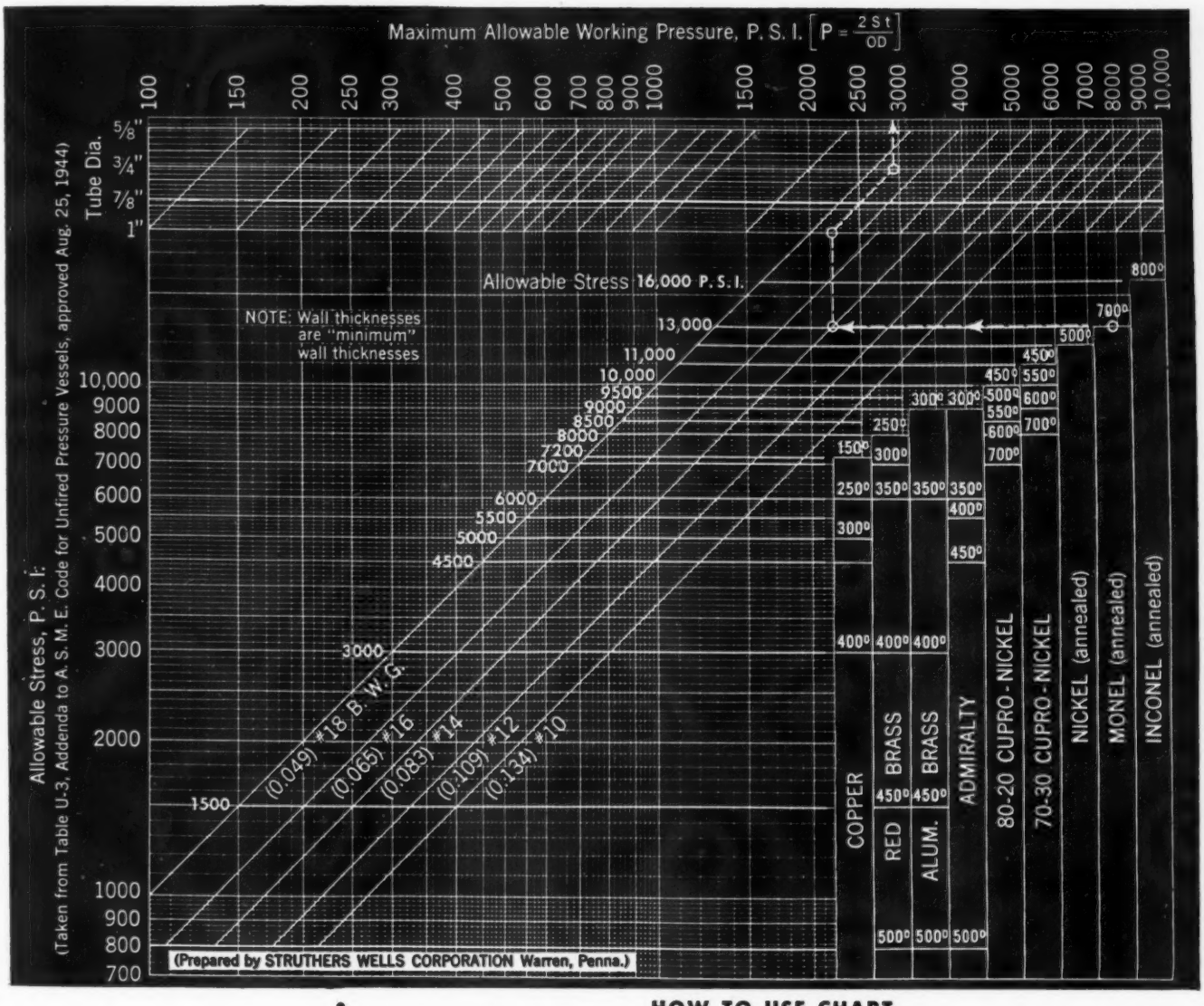
Illinois Institute of Technology is again offering fellowships, scholarships and assistantships for term beginning Sept 22, 1947, to further stimulate graduate study in science and engineering. Among fellowships that permit advanced study with unusual experience in special fields of research leading to either a master of science or a doctor of philosophy degree are: Illinois Institute of Technology research fellowships, Universal Oil Products fellowship in chemistry, Westinghouse educational foundation fellowship in power systems engineering, Institute of Gas Technology fellowships in cooperation with the affiliated Institute of Gas Technology, and Armour Research Foundation industrial research fellowships.

Washington Award in recognition of devoted and pre-eminent service of human progress was conferred upon Dr Karl T Compton, president, Massachusetts Institute of Technology, by Western Society of Engineers on Feb 26 in grand ballroom of Continental Hotel, Chicago, for his scientific and engineering activities.

Condenser Service & Engrg Co, Hoboken, N. J., has been awarded a contract for constructing and installing three 70,000-sq-ft condensers for Wilmington Harbor plant of the City of Los Angeles.

How to select PRESSURE TUBING

This chart quickly gives you the MAXIMUM ALLOWABLE WORKING PRESSURES under the A.S.M.E. Unified Pressure Vessel Code for given wall thicknesses and outside diameters of typical non-ferrous tubing in U-tube constructions



HOW TO USE CHART

Sample problem: Find the maximum allowable working pressure for 3/4" O.D. Monel* tubing with a wall thickness of 0.083" (#14 B.W.G.).

1. Enter the grey column labeled MONEL. Go to its top, at the 13,000 P.S.I. Allowable Stress level.
2. Move left along the 13,000 P.S.I. level until it intersects the diagonal labeled (0.083) #14 B.W.G.
3. From this point of intersection, move vertically up to the horizontal line marked 1" Tube Dia.
4. From this new point of intersection, move diagonally to the upper right, keeping parallel to the diagonal lines, until you reach the horizontal line marked 3/4" Tube Dia.
5. Vertically above this final point of intersection, is the maximum allowable working pressure — approximately 2,880 P.S.I.

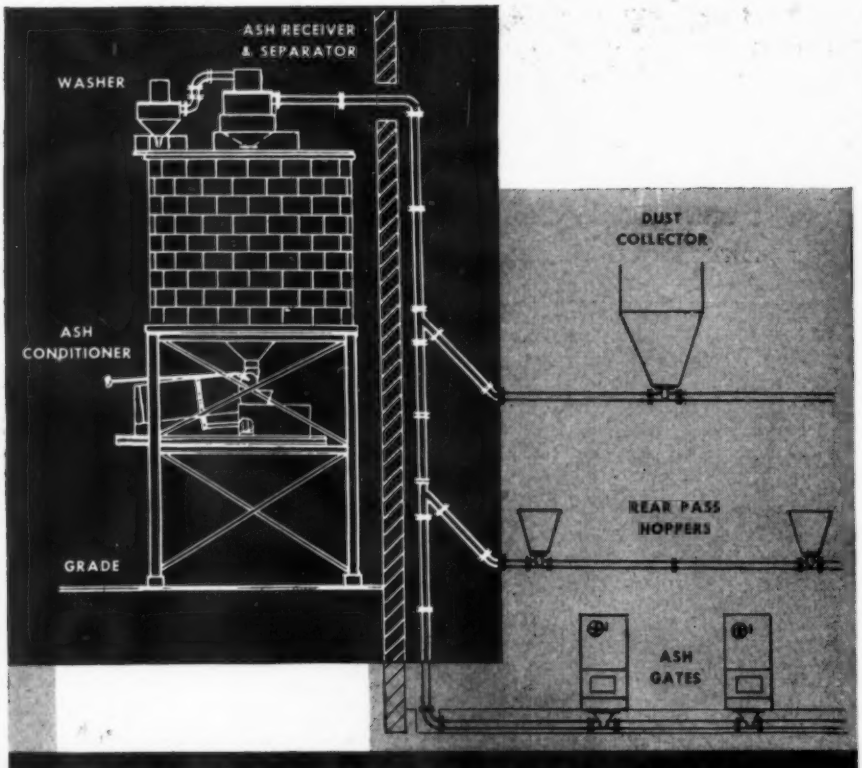
PRESSURE TUBING of Monel, Nickel or Inconel* offers outstanding usefulness wherever high pressures and temperatures are involved. For example, these strong, thermally-durable alloys are ideal for U-tube high-pressure feedwater preheaters. *Reg. U.S. Pat. Off.

Reprints of this Time-Saving Chart are available upon request.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N. Y.

NICKEL (INCO TRADE MARK) ALLOYS

MONEL* • "K"* MONEL • "S"* MONEL • "R"* MONEL • "KR"* MONEL • INCONEL* • NICKEL • "L"* NICKEL • "Z"* NICKEL



CUT ASH REMOVAL COSTS . . .

WITH A BEAUMONT *"Vac-Veyor"* SYSTEM

Want to lower your ash removal costs—and obtain increased efficiency and greater cleanliness at the same time?

The Beaumont "Vac-Veyor" System offers you the most direct and simple method for doing it.

With this system, the ashes, siftings, soot and dust are conveyed from the ash pits, dust collectors, stack, etc. to an ash receiver and separator at the top side of a silo—through a pipe, by means of a vacuum.

Only one man operates the system—keeps your plant cleaner with less labor. Initial and operating costs are rock-bottom. Maintenance costs stay constantly low.

If your needs are immediate—phone us. If you want more information—write. But start cutting those costs NOW.

BEAUMONT BIRCH *Company*

1502 RACE STREET • PHILADELPHIA 2, PA.

Designers *Manufacturers* *Erectors* BULK MATERIAL HANDLING SYSTEMS

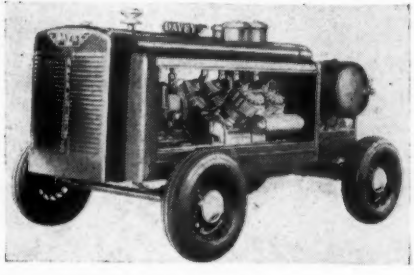
New Equipment

(*Continued from page* 134)

leads are adequate because of lower control power requirement with pneumatic operation. Tank sizes have been reduced with a decrease in over-all weight and oil content. A large size manhole provides access to interior of tank for maintenance. A bushing potential device provides a source of energy for operation of relays, voltmeters and synchroscopes. **Dept P, General Electric Co, Schenectady 5, N. Y.**

Tilting Pump Base

BELT-DRIVING PUMP on tilting basis for use where the unit must be readily started and stopped. Base is made of bronze. Pump has double-sealed grease-packed outboard shaft bearing, which retains lubricant indefinitely. Convenient method of belt tightening holds pump at any angle up to 45 deg. Tilting base fits all ½- and 1-in. single- and double-impeller gearless pumps. **Dept P, ECO Engrg Co, 113 New York Ave, Newark 1, N. J.**



Air Compressor

MODEL 160 AIR CHIEF AIR COMPRESSOR is available in standard skid, steel-wheel trailer and pneumatic-tire trailer mounting. Compressor unit is of double-V design, with three low-pressure cylinders and one high-pressure cylinder. All cylinders have a 5¾-in. bore and 4-in. stroke. Standard gas units are equipped with *Hercules JXD* engines. The three low-pressure cylinders are fitted with individual air cleaners. Side tool boxes are included in all models as regular equipment. Gas tank is conveniently located beneath air receiver. **Dept P, Davey Compressor Co, Kent, Ohio.**

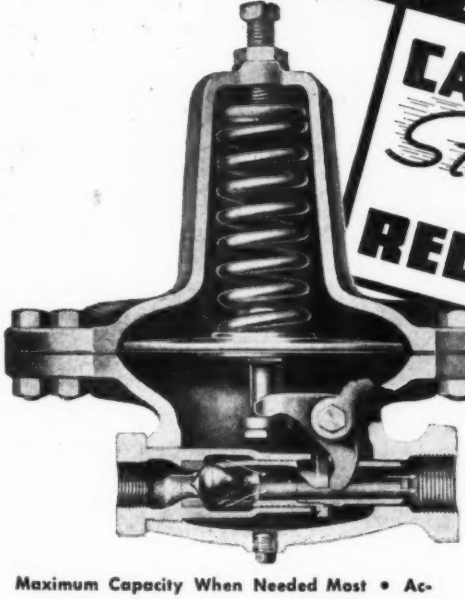
High-Current Ignition

THIS LARGE SEALED IGNITRON, with an average current rating of 400 amp, represents an extension of the line that up to now has included tubes with 100- and 200-amp current ratings. Primary application of this tube is in power rectifiers for mining, electrochemical, transportation, steel and other similar industries. Using a sealed steel mercury tube, this new ignitron has two ignitors, only one of which is utilized at a time. Efficient operation results from the low arc loss. Safe control

ARE THESE COST MAKERS
Always Tripping You Up?

GET RID OF THEM WITH...

CASH STANDARD *Streamlined* PRESSURE REDUCING VALVE TYPE 1000



Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

VALVES can be mighty sore spots on any line, particularly when they are affiliated with such cost makers as you see here.

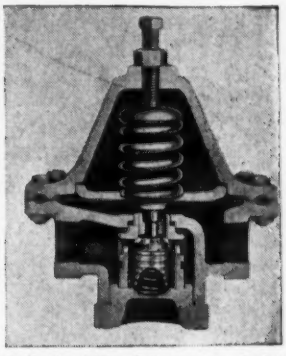
Why go along under such conditions when the Streamlined Type 1000, CASH STANDARD changes the picture completely. It is then that you find new savings in costs and such other benefits that you can read right on this page.

WRITE FOR BULLETIN "962" — read the construction details of the "1000" and how it performs in your favor.

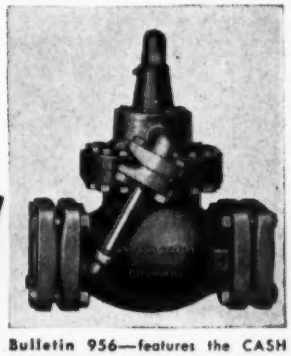
CASH STANDARD CONTROLS... VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

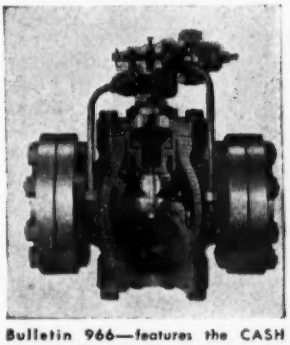
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

Seven league boots are out of date!

The fastest way *these* days to get supplies and parts for clamoring customers is by super-speedy Air Express. It's like having all your suppliers "right next door" when you specify Air Express delivery. No source — including many abroad — is more than mere hours away.

Planes carrying your Air Express shipments are bigger and faster today, and schedules are more frequent. Air speeds up to five miles a minute make coast-to-coast overnight delivery routine. Air Express rates are low. So keep customers satisfied, and do more business, too. Profit from the speed of Air Express.

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To Air Express a 16-lb. shipment 1349 miles costs only $6.39! Heavier weights — any distance — similarly inexpensive. Investigate!

of firing of the ignitor permits voltage control of rectified output.

Excitation of a small auxiliary anode stabilizes the cathode spot for very small anode currents. A unit about 100 lb in weight and 2 ft. in height, this tube provides the control characteristics of a thyratron, the versatility of the half-wave tube in circuit application work and the very high emission capacity of the mercury pool. **Dept P, General Electric Co, Schenectady 5, N. Y.**

Fire Nozzle

FIRE-HOSE NOZZLE supplies finely atomized water with medium pressures as normally provided by city-water systems. Manufacturer reports a 20-ft fog projection at 50-psi nozzle pressure with a discharge of 15.9 gpm. At 75-psi nozzle pressure the projection is increased to 25 ft, with a discharge of 19.3 gpm. Nozzle produces a curtain of protecting fog in front of the operator, shielding him from the intense heat of the flame. **Dept P, Bowser Inc, Ft. Wayne, Ind.**

Steam Trap

BALL-FLOAT STEAM TRAP uses a stainless-steel sliding valve and stainless-steel float. Orifice holder and slide holder, float-ball lever and internal lever are bronze, but can be stainless steel or any other suitable metal. A side cover carries slide valve, lever and float, and condensate outlet. By loosening four screws, the cover can be removed to inspect moving parts. Both inlet and outlet mount on same side of housing.

Trap is equipped with a simple drainage lever that can be manually operated to raise the float, open valve, and drain condensate from the body. Air can be released by a hand-operated valve mounted on top of case. A thermostatic air release up to 100 psi can be furnished. **Dept P, W S Rockwell Co, 200 Eliot St, Fairfield, Conn.**

DC. Regulator

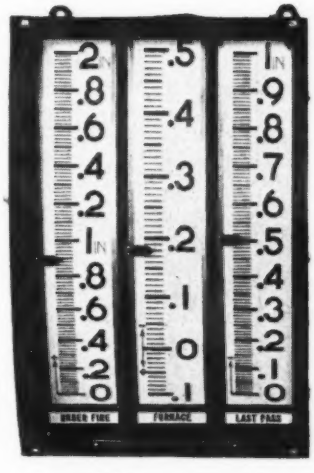
REGULATED DC VOLTAGES at currents and stabilities previously available only with batteries are now possible through voltage-regulation units called *Nobatrons*. These units are available in six standard models, which operate on a 95-125 v source of 50- to 60-cycle ac power and provide ratings of 5, 10 or 15 amp with output voltages of 6, 12 or 28 v, respectively. Regulation accuracies of ½ of 1%, maximum ripple voltage (rms) of 1% and recovery time of 1/5th of a second, according to manufacturer, make *Nobatrons* ideally suited for critical applications where constant, unvarying dc voltages are required.

Some important applications of *Nobatrons* are in dc ammeter calibration, standardization and quality control laboratories, photographic studios for furnishing power to light sources, battery-operated relays, supplying current to filaments of dc amplifiers, and other places where it is desirable to replace batteries with a continuous regulated supply. *Nobatron* units have an

DRAFT GAGES in PRACTICAL, *Convenient and* ECONOMICAL SIZES

Series FOT
size
14" x 12"

Series D
size
12¼" x 9½"



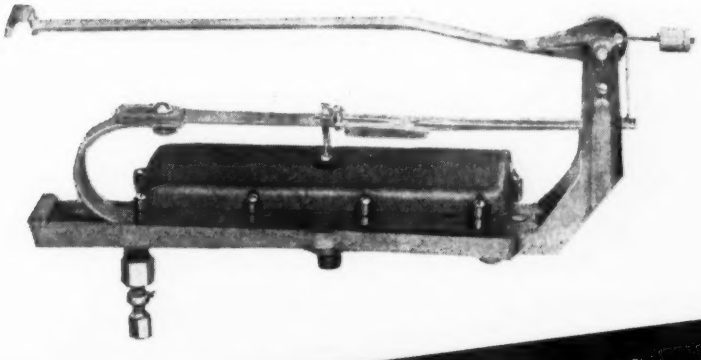
Series V
size
12½" x 7"

Series B
size
7" x 5"

HAYS offers a complete line of pointer-type draft gages designed to fit every need and every budget.

No longer is it necessary to buy a large gage when a small one is available that will serve quite as well or better. No longer need you try to make one size gage handle all drafts.

All these gages have the famous Hays slack diaphragm unit for ranges of draft or pressure from 0 to 120 inches of water. For ranges above 100 inches, Bourdon Tubes are used. For full description of these better gages, in all sizes and ranges, send for Bulletin 45-667.



The HAYS CORPORATION
SINCE 1903
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

This is Inland 4-Way Floor Plate

Yes, this is Inland 4-Way Floor Plate . . . that safe, dependable steel flooring that guards against dangerous slips and falls . . . and lasts for years and years.

For floors, steps, walkways, platforms and elevator hatchways, it provides structural strength and safety. The attractive 4-way pattern cleans easily and drains freely.

If your plant, building or product needs added safety under foot or wheel, you'll want to know more about Inland 4-Way Floor Plate . . . Available for immediate delivery from conveniently located steel warehouse distributors.

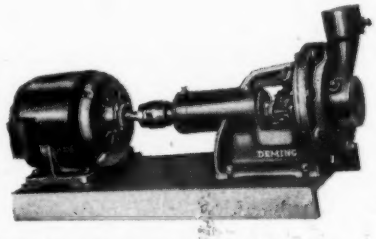
SAFE, ECONOMICAL
EASY TO INSTALL
Write for Catalog

INLAND STEEL COMPANY
38 S. Dearborn Street — Chicago 3, Ill.
Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

on-off line switch, voltage adjustment, control-circuit fuse and pilot light. Models are available either for panel mountings or inclosed in a cabinet. **Dept P, Sorensen & Co, 375 Fairfield Ave, Stamford, Conn.**

Oil Gage

GAGE BODY is machined from hexagonal bar stock and a heavy central stem with top cap, which supports the unbreakable plastic sights. An independent nut locks unit together, compressing the gaskets and eliminating any chance of leakage. Gage can be taken apart for cleaning by simply removing top nut. Plastic sights eliminate hazard of broken glass and provide full vision from all angles. Standard sizes range from 2½ to 5 in.; sight diameters are ½, ⅜ and ½ in. NPT. **Dept P, Oil-Rite Corp, 3478 S 13th St, Milwaukee 7, Wis.**



Side-Suction Pump

NEW LINE of standardized side-suction centrifugal pump meets wide range of pumping needs in industry. Pump is made in three types: (1) single ball bearing with open impeller (2) two ball bearings with open impeller (3) two ball bearings and semi-inclosed impeller. All designs are for belt drive or direct-connection to electric motors. Pump is available in ½-, ¾-, 1-, 1½- and 2-in. sizes and 2- to 200-gpm capacity **Dept P, Deming Co, Salem, Ohio.**

Alkalinity Indicator

TRUTEST TWO-IN-ONE INDICATOR measures water alkalinity by direct titration method and does not change the general procedure now employed with phenolphthalein and methyl orange. Main difference is that one chemical takes the place of two. Manufacturer says that the new indicator has two end points and gives sharp color definitions.

Same sample, after being used for the alkalinity titration, can serve for the chloride determination because the new indicator does not interfere with the test. **Dept P, TruTest Laboratories, Inc, 20 S 33rd St, Philadelphia 4, Pa.**

Soot Scraper

SHIELDED AND PERMANENTLY GREASED ball bearings free new power-driven soot scraper from lubrication needs, claims its manufacturer. This permits an operating hookup free of any lubricator provision so that the scraper connects to the hose or pipe carrying steam or air, ready for work. In addition, bearing housings are reputed to

The OIL COOLER with the VISIBLE SEAL

THE G-R MULTIWHIRL OIL COOLER

No need to worry about whether there's a leak between the oil and cooling water in your lubricating oil cooler or transformer oil cooler if it's a G-R Multiwhirl.

In this unit an outside-packed floating head eliminates the possibility of leakage between liquids through faulty packing, and any leak at this point is immediately visible and can be remedied by tightening the gland.

The floating head also permits free expansion and contraction of the tubes, and additional advantages of the G-R Multiwhirl design are the special arrangement of baffles to suit the duty and pressure drop specifications, the thorough and lasting tightness of the tube ends in both tube sheets, and the provisions for ease of inspection and cleaning.

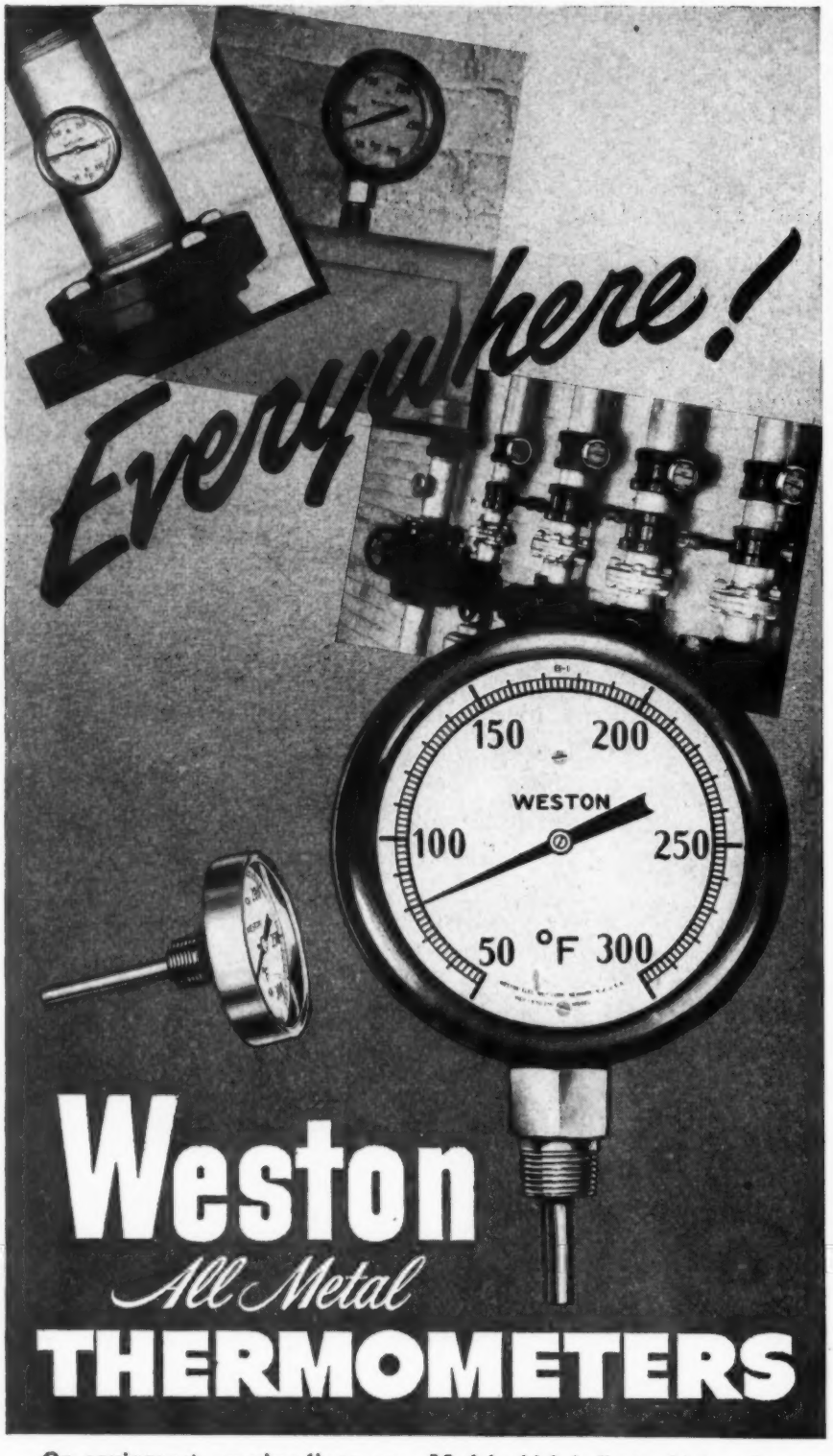
Write for Form 710 describing these units.

THE GRISCOM-RUSSELL CO.
285 Madison Avenue, New York 17, N. Y.

G-R-184

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

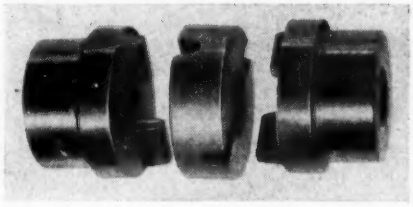


On equipment, on pipe lines, on bearings . . . wherever temperatures are critical, the WESTON Thermometer is now widely used because of its *readability*, its all-metal *ruggedness*, and its proved, long-time *dependability*. Available for general requirements, including a Max-Min Model which indicates high or low temperature reached since last setting. If your jobber cannot supply you, ask your local WESTON representative, or write . . . Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON *Instruments*

keep ball bearings in position without slip.

Scraper loosens soot and incrustation by action of a whirling blade, driven by energy from steam or air. Exhaust blows out the loosened soot. **Dept P, Brunt Equipment Co, 64 S Division St, Buffalo 3, N. Y.**

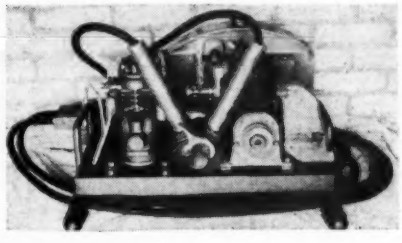


Flexible Coupling

THREE-PIECE GEAR-TOOTH flexible coupling consists of two identical steel end pieces with involute gear teeth that mate with a center piece containing rack grooves running transversely on opposite sides. Each end piece has two setscrews, one on the key and one 120 deg from keyway. Unless otherwise specified, center piece is made of lubricant-impregnated sintered bronze. Coupling provides simultaneous automatic correction for up to 2-deg angular and liberal parallel misalignment. It is available in wide range of standard bores for ¼- to 1¾-in. shafts. **Dept P, Industrial Machine Works, South Hanover, Mass.**

Brazing Rod

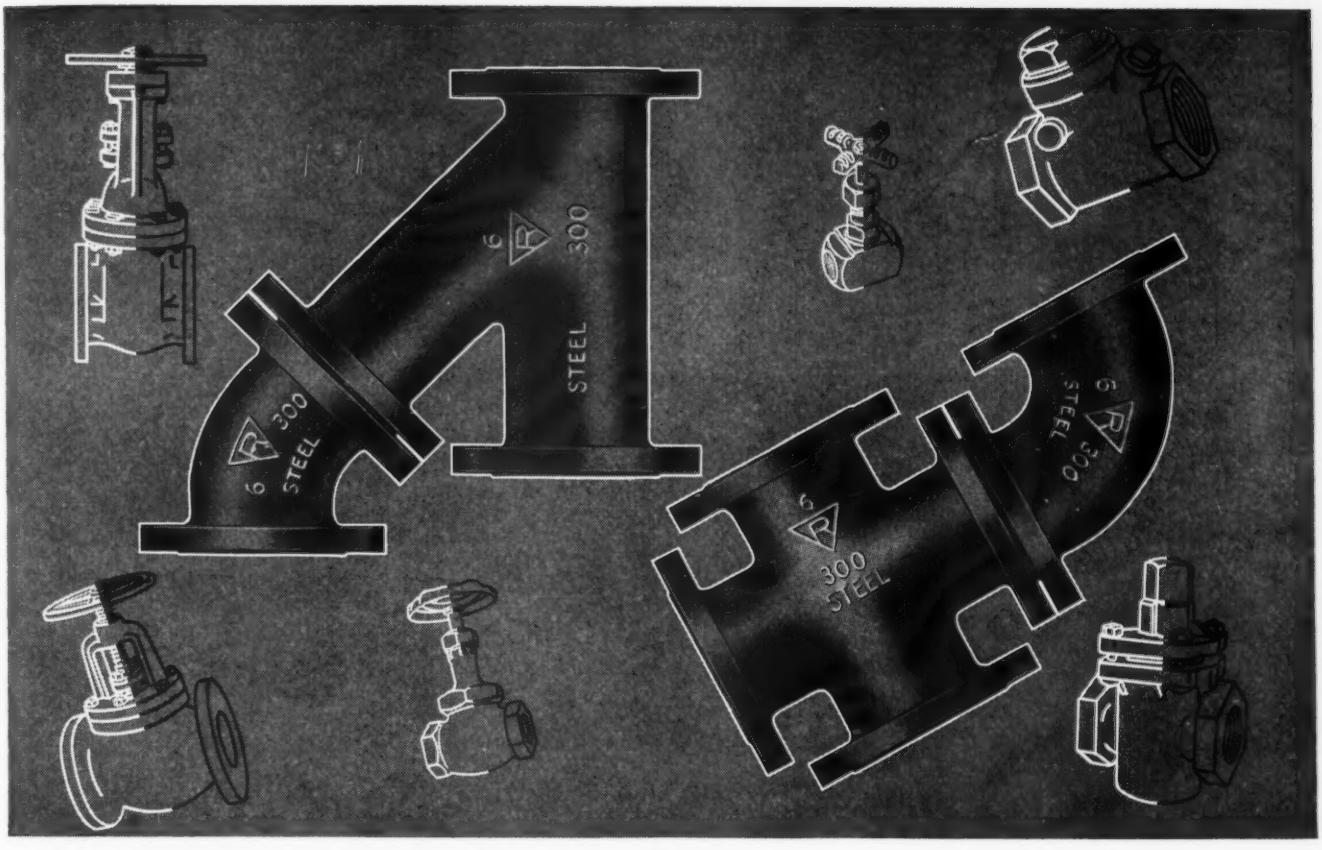
NEW BRAZING ROD for sheet aluminum makes smooth clean joints and serves particularly well on thin sections. Its melting temperature is well below that of sheet aluminum and therefore less preheat and less flux is required to do a good job. The rod produces corrosion-resistant weld with a tensile strength of 30,000 psi. New product is known as *All-State No.* 31 sheet aluminum brazing rod. **Dept P, All-State Welding Alloys Co, 96 West Post Road, White Plains, N. Y.**



Pipe Freezer

FREEZ-SEAL APPARATUS consists of a freezing tool connected by flexible tubes to a portable refrigeration unit. Freezing tool is designed in form of a pair of clips that clamp around pipe. Copper bushings are supplied, which makes the tool easily adjustable to various pipe sizes.

Included with the machine is a pipe-closing clamp and a drip tool that punctures the pipe and allows a regulated amount of water to escape during freezing operation. Pipe clamp can be used to squeeze the pipe flat in case of a bad



LOOK TO READING-PRATT & CADY FOR HIGH QUALITY CAST STEEL FITTINGS

Your assembled piping systems require accuracy in dimensions. The precision with which they go together is important to you. Every R-P & C fitting is a fine pressure steel casting—accurately machined to close tolerances.

READING, PENNSYLVANIA — Reading-Pratt & Cady pioneered in the development of pressure steel castings for valves and fittings.

This fact is not important in itself. But constant improvements in engineering, in foundry and shop methods and in inspection techniques have resulted in better products—have given us the "know-how." R-P & C steel valves and fittings made today are better than ever before. And that is important to you.

Consider your Reading-Pratt & Cady distributor as a responsible source for cast steel globe, angle, gate and check valves, as well as cast steel fittings. He also offers a wide range of bronze and iron valves.

ACCO

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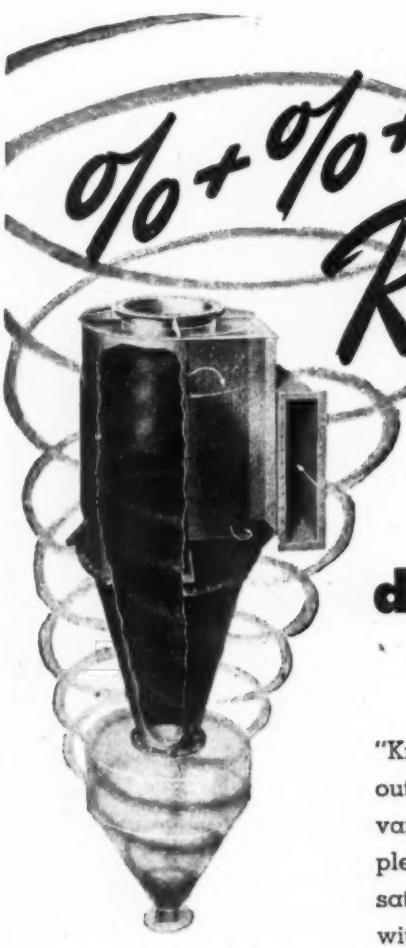
READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE-MARK



9/10 + 9/10 + 9/10 + 9/10 Recovery...

the crux of dust separation

"Know Your Dust," says Buell. 999 times out of a thousand, the percentages of various micron sizes establish a complex separation problem. To anticipate satisfactory separation you must know with just what efficiency your collection apparatus will handle each of the different size particles present.

A Buell Fractional Efficiency curve will tell the complete story. Not a round-figure overall promise, but an analytical certification of performance on each of the sizes of your total dust.

Buell engineering can tailor equipment to your most exacting demands. And, instead of being complex, the layout will be relatively simple, the diameters relatively large — and draft demand and maintenance costs low.

The Shave off is the pay off—a van Tongeren System patented feature found only in Buell equipment. The how and why of it is graphically presented in a reference catalog every interested engineer should read. Write for "The van Tongeren System of Industrial Dust Recovery", Buell Engineering Co., 70 Pine Street, New York 5, N. Y.

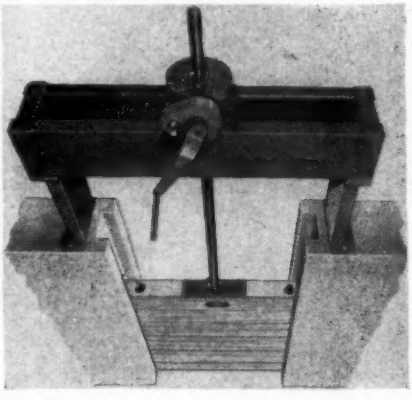
buell

Engineered Efficiency IN DUST RECOVERY

burst. Controlled drip tool allows a flow of water, thus assuring that the ice plug is formed with a hollow center of a gradually diminishing bore, until the final moment of seal. After pipe has been frozen, repairs can be completed and ice plug allowed to thaw itself loose. **Dept P, Freez-Seal Equipment Co Ltd, 245 Burlington Rd, New Malden, Surrey, England.**

Lightweight Conveyor

LIGHTWEIGHT PORTABLE POWER CONVEYOR handles bags, boxes, crates, cartons, baskets and all kinds of packaged material. Made of corrosion- and abrasion-resistant alloy steel, the 10-ft model weighs only 291 lb, complete with power unit and undercarriage. Conveyor can be moved easily by one man from one job to another. Electric motor coupled to gear reducer powers the conveyor, which is 5½ in. deep and has 8-in. belt. Rear wheels of undercarriage are solid, front wheels have swivel casters. Either end of 10-ft model can be raised 6 ft. Recommended carrying capacity, 40 lb per ft, distributed load. **Dept P, Material Movement Industries, 310 S Michigan Ave, Chicago 4, Ill.**

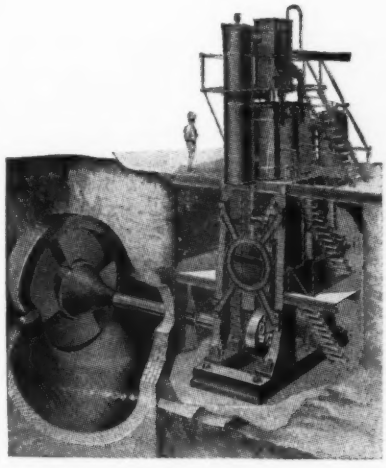


Self-Contained Gate

A SIMPLE, PRACTICAL, easily installed hydraulic wood gate and control cuts installation time to minimum. Positive, self-locking, easily operated control may be installed for either hand or direct-connected electric-motor operation. Gate stands of many capacities are readily installed with several size gates. Wood gates are designed for any thrust load imposed during closing. **Dept P, Rodney Hunt Machine Co, Orange, Mass.**

Sludge Solvent

O'B-OIL IS A SOLVENT that brings under control the gums, resins, sludge and water emulsions that accumulate in fuel and diesel oils during transportation and storage. *O'B-Oil* is a properly balanced compound consisting of a wetting agent for efficient dispersion, alcohol for water separation, a chlorinated solvent and an aromatic solvent. The formula includes only active ingredients and contains no diluents. Flashpoints and firepoints are high enough so that *O'B-Oil* is classified as non-inflammable; yet all ingredients are com-



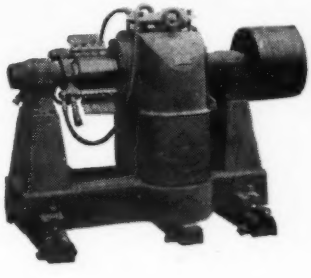
65 YEARS

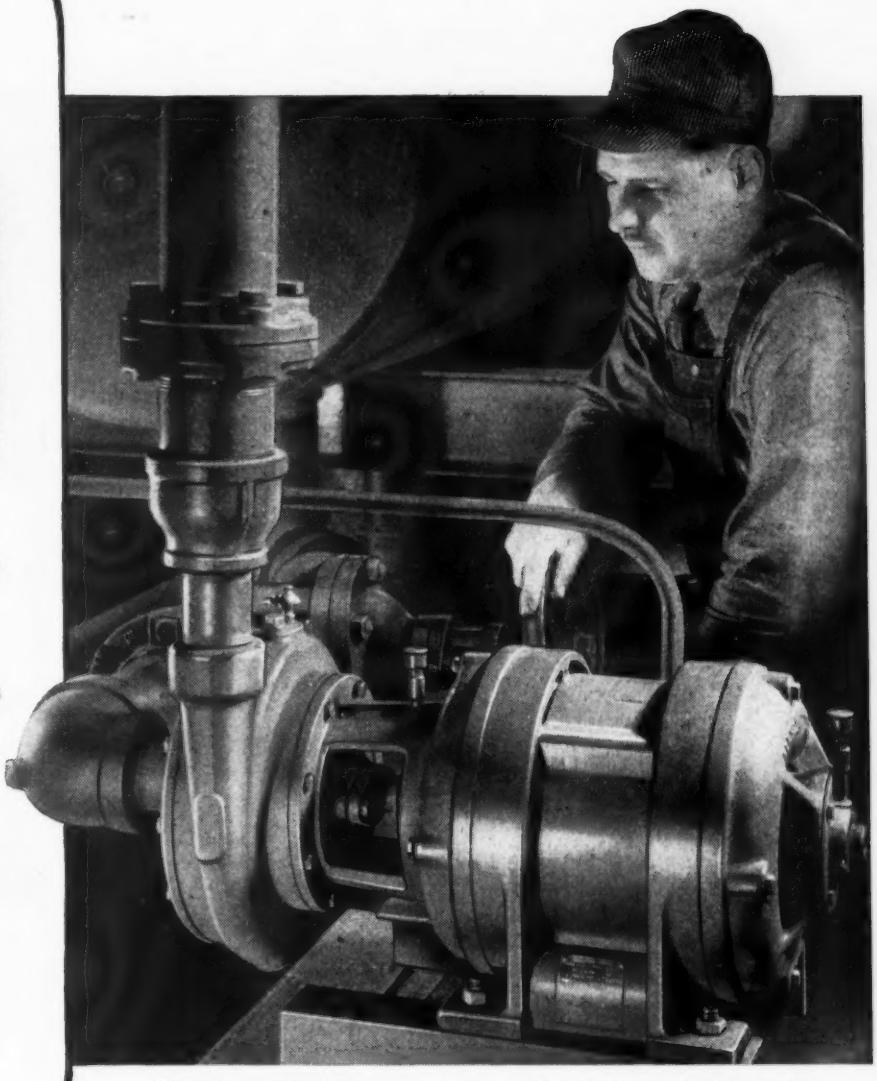
of experience building centrifugal pumps

PLUS

Experience building electric motors for

57 YEARS





Allis-Chalmers SS-Unit Pump — extremely versatile, low in cost, high degree of efficiency. A single suction centrifugal pump and motor, designed and built as a compact unit. In 234 standard ratings, 10 to 2,500 gpm, heads to 575 ft.

...122 Years Combined Experience applied to YOUR pumping problems!

YOU'RE GOING to headquarters when you call on Allis-Chalmers for pumps! No other manufacturer can offer you the wealth of *combined* centrifugal pump and motor experience. This is important, too. For pump and motor must be designed and matched as a team to assure a pumping unit of highest efficiency, economy and reliability. Undivided responsibility is a further guarantee of satisfaction over the years.

What are your requirements? Allis-Chalmers offers large or small pumps to operate at high or low heads. — Also, special pumps to handle liquids of high solid content and corrosive or abrasive liquids. Call your nearest A-C office, see Sweet's, or write for Bulletin 6059-D. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

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A CENTURY OF SERVICE to Industry THAT MADE America Great

HERE'S THE NEW LINE OF Series K
ROPER ROTARY PUMPS

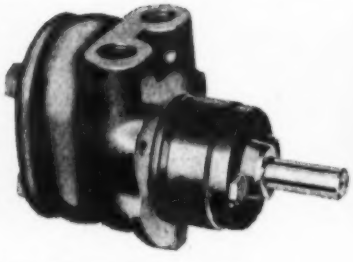


FIG. 17K PUMP HEAD with Mechanical Seal. Sizes ¾, 1½, and 3 g.p.m., as illustrated. Fig. 18K is equipped with built-in relief valve. Packed Box is available.

FIG. 1K with Packed Box. Available in 5 g. p. m. size only. Fig. 2K is equipped with built-in relief valve. Mechanical seal is available.

FIG. 1K with Packed Box — supplied in 10, 15, 20 g.p.m. sizes with companion flanges. FIG. 2K equipped with built-in relief valve. Mechanical Seal available on all models.

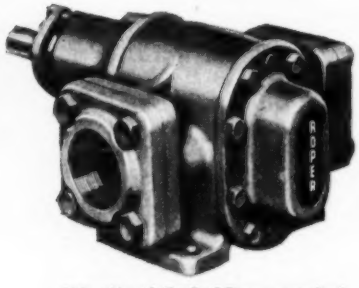


FIG. 1K with Packed Box — supplied in 30, 40, 50 g.p.m. sizes with companion flanges. FIG. 2K equipped with built-in relief valve. Mechanical Seal available on all models.

¾ TO 50 G.P.M. — PRESSURES TO 150 P.S.I.

Adaptable to a wide range of jobs . . . pressure lubrication, hydraulic service, fuel supply, or transfer work pumping clean liquids. These Ropers are self-priming, operate in either direction, handle total suction lifts up to 25 feet. Direct connected, belt, or chain driven. Because of the new Roper venturi suction and discharge principle, energy loss from cavitation, turbulence, and friction is minimized. This proportional means of distributing viscous liquids uniformly across the gear face increases operating efficiency . . . adds quietness and reduces power costs . . . permits gears to handle a wide range of viscous liquids at standard motor speeds.

Get All Of The Facts— Send For Booklet

Complete Model "K" details including specifications, exploded view of construction features, wide range of mountings, etc. Also describes other models up to 300 G.P.M., pressures up to 1000 P.S.I.

GEO. D. ROPER CORPORATION
353 Blackhawk Park Ave., Rockford, Ill.

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS

ROPER Rotary Pumps

BUILDERS OF PUMPS FOR MANUFACTURING, MARINE, PETROLEUM, AND PROCESS INDUSTRIES

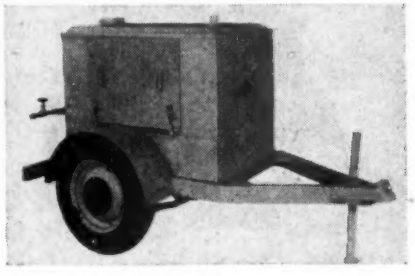
bustible when fed to fuel-oil burners. This material does not corrode tanks or equipment when mixed with fuel oil, and contains no caustic soda. **Dept P, O'Brien Industries, 101 City Ave, Bala-Cynwyd, Pa.**

Air Regulator

AIR-PRESSURE REGULATOR is adjustable to function in systems operating at pressures ranging from 10 to 150 psi. Regulator keeps pressure at the equipment constant, regardless of wide variation in system pressure. Air to any working machine or part, such as air cylinders, machine controls, etc, is delivered at pressure for which regulator is set, saving wear and tear on compressor and reducing air cost. **Dept P, A Schrader's Son, div of Scovill Mfg Co, Brooklyn 17, N. Y.**

Degreaser

HIGH FLASHPOINT, phenolic-free compound has penetrating and carbon-softening properties that remove deposits by cold emersion. Absence of phenol and high flashpoint make *Formula* 555 safe for the operator. It is also fire resistant. Product, for cleaning diesel-engine parts, fuel pumps, carburetors, filter screens, comes in 55- and 15-gal drums, as well as 5-gal cans. **Dept P, Kelite Products, Inc, Box 2917 Terminal Annex, Los Angeles 54, Calif.**



Vapor Cleaner

NEW MODEL inclosed-coil, down-draft steam generator has a simplified grouping of gages and controls and has added a compressed-air valve accessory for a 2-minute anti-freezing of the water system, states its manufacturer.

Fuel tank, 12-gal capacity, can supply sufficient fuel for steam demand of an 8-hr, 2-gun cleaning cycle (100 lb of steam per min) using wet or dry steam up to 200-psi. Unit with triple-insulated fire chamber, separate solution tank and a ¼-hp 60-cycle 110-220-v ac motor, comes in portable and stationary models. **Dept P, Oakite Products, Inc, 123 Thames St, New York 6, N. Y.**

Lightweight Elevator

LIGHTWEIGHT PORTABLE ELEVATOR handles a variety of commodities weighing up to 1000 lb. Machine is simple and maneuverable. Platform 22x24 in. for passing through narrow aisles and height of 68 in. clears average doorway. It has a lift of 55 in. Elevator has crankup and crankdown

APAC, used as exterior siding on this 4000 ft. long aircraft assembly building, combines streamlined design with permanence. Designed by The Austin Company.

TIME ONLY TOUGHENS . . .

K & M "Century" APAC

● Yes, K&M "Century" APAC Asbestos-cement board can really take it . . . and it gets tougher as time passes. Completely fire-resistant, weather-proof and rot-proof, APAC was specified and used for these and many other reasons on the huge assembly plant shown above.

Made of asbestos and Portland Cement, APAC comes in 4′ x 8′ sheet sizes, 3/16", 1/4" and 3/8" thick. Though almost rock-like in hardness, APAC is easy to cut and fit on the job. Once in place, it lasts indefinitely, without maintenance or protective painting; its low first cost is last cost.

Write for details on how APAC serves industry in many valuable ways . . . as office panelling, inside sheathing, partitions, shower stalls, elevator casings, walls and sidings.

Nature made Asbestos
Keasbey & Mattison has made it serve mankind since 1873

K&M best in asbestos

Reg. U. S. Pat. Off.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
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hoist with no gravity drop. End of cable is readily placed either on machine top for 2-part arrangement or directly on the platform for more quickly elevating half-full load. Cable may be connected around load to drag it on the platform by cranking. Machine serves need for short-lift elevator where electric power is not available. **Dept P, Revolvator Co, North Bergen, N. J.**

Aluminum Flux

A LOW MELTING POINT, 950 F, coupled with a flux breakdown into the liquid state, gives capillary action to aluminum brazing alloy. Manufacturer claims additional features of (1) little flux residue on the work if heated welded parts are submerged in hot water. (2) wetting action during preheat period goes from powder form directly to clear liquid, which carries brazing alloy along seams or joints to be welded. All-State *No.* 31*A* flux should be used with All-State *No.* 31 sheet aluminum brazing rod. **Dept P, All-State Welding Alloys Co, 96 West Post Road, White Plains, N. Y.**

Refractory Cement

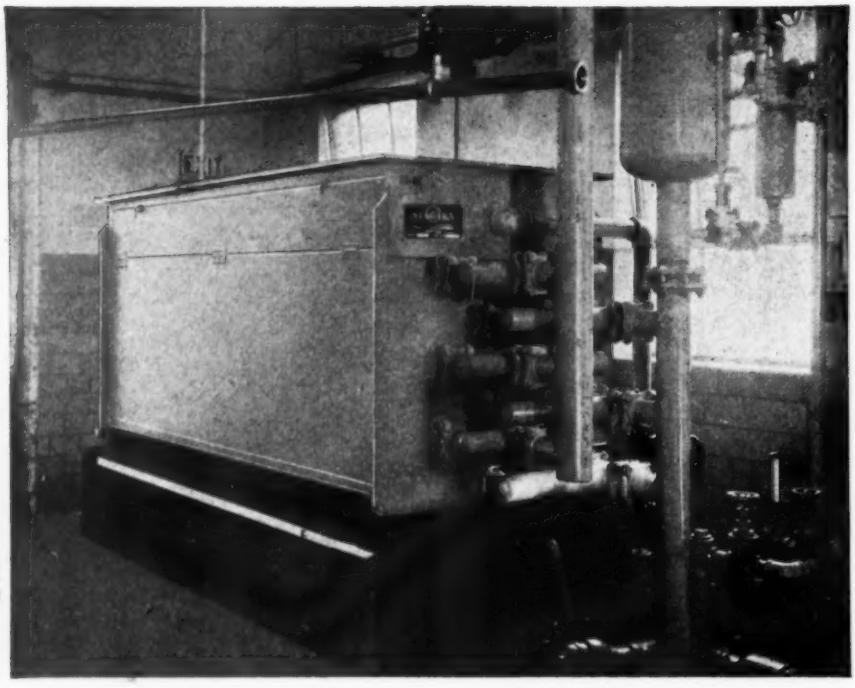
HIGH-TEMPERATURE (3000-F) resistant refractory cement possesses, its manufacturer states, stability and resistance to spalling, small volume change on initial firing, lack of shrinkage or expansion under continuous use at high temperatures.

Kaocast comes in dry form, ready mixed, and requires only water to make it ready for application. Mixture can be poured into place like ordinary concrete or used as a ramming material. **Dept P, Babcock & Wilcox Co, 85 Liberty St, New York 6, N. Y.**

Automatic Controller

NEW ELECTRONIC CONTROLLER is for industries that rely upon thermometers and pressure gages for manufacturing and processing. Some processes, heretofore controllable only with electronic potentiometers, can now employ the new instrument to obtain desired results. *Electr-O-Vane* control operates on principle that when a metal vane is interposed between two oscillator coils, state of oscillation can be made to change or stop in an electronic circuit. This change causes electronic circuit to operate a load relay. Oscillator coils are molded in bakelite and are moistureproof. Temperature instrument is applicable to processes that demand accurate control of temperature, ranging from minus 100 to 1000 F. **Dept P, Brown Instrument Co., Philadelphia.**

Two power engineers received academic honors around the first of Feb. August C Klein, vice-president, Stone & Webster Engrg Corp, was awarded degree of Doctor of Engineering by Stevens Institute of Technology, Hoboken, N. J. Case School of Applied Science, Cleveland, Ohio, conferred the same degree on Philip W Swain, editor of POWER.



NIAGARA LIQUID COOLER Gives High Capacity in Small Space

Cold water, chilled to 33° F., or cold liquids, or non-freezing solutions below 32° F. are produced economically by the new Niagara Liquid Cooler.

For large capacity equipment it is most compact. For example, one model furnishes 92 gallons per minute of water cooled from 45° F. to 35° F., with 28° F. refrigerant temperature, in less than 30 sq. ft. of floor space. Other models . . . from 24 to 465 G. P. M.

Extra advantages are positive temperature control; assurance of holding temperature accurately in spite of variation in cooling load; rapid chilling of the liquid; savings in power and refrigeration consumption.

Write for Bulletin No. 100 P.

NIAGARA BLOWER COMPANY

Over 30 Years' Experience in Industrial Air Engineering

405 Lexington Ave. NEW YORK 17, N. Y.

Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Scientific Metal Distribution

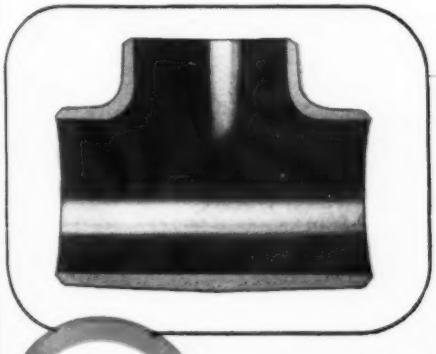
(Based on Strain Measurements)

ASSURES DEPENDABLE SERVICE FROM LADISH SEAMLESS WELDING FITTINGS

Scientific distribution of metal in the wall sections of Ladish Seamless Welding Fittings accounts in large measure for their high dynamic strength and dependability. Under the Ladish forming process, high quality steel tubing is worked under compression at forging temperatures wherein the flow of hot, plastic metal is controlled to provide desired cross section thickness at all points.

In Ladish Tees this permits concentration of additional metal at points of greatest stress — crotch, sides and bottom of run — yet tapers the fitting to nominal pipe size at all outlets. In Ladish Ells and Returns the flow of metal is controlled to produce uniform wall thickness.

Smooth inner surfaces, full effective radii, unrestricted circularity, geometric accuracy, permanent identification and heat code protection . . . these are additional features that assure long service when you "call your Ladish distributor for CONTROLLED QUALITY Seamless Welding Fittings."



◀ Section view at left illustrates how scientific metal distribution provides maximum strength at crotch and at sides and bottom of run.

◀ This cutaway illustration shows the uniform wall thickness achieved in Ladish Ells and Returns.

TO MARK PROGRESS

Controlled Quality FITTINGS

LADISH CO.

CUDAHY, WISCONSIN

MILWAUKEE SUBURB

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SEND TODAY FOR THIS DIMENSIONAL DATA FOLDER

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Dept. P-5
Cudahy, Wisconsin

Please send me the handy 10-page data folder giving dimensions, weights and part number of Ladish Seamless Welding Fittings.

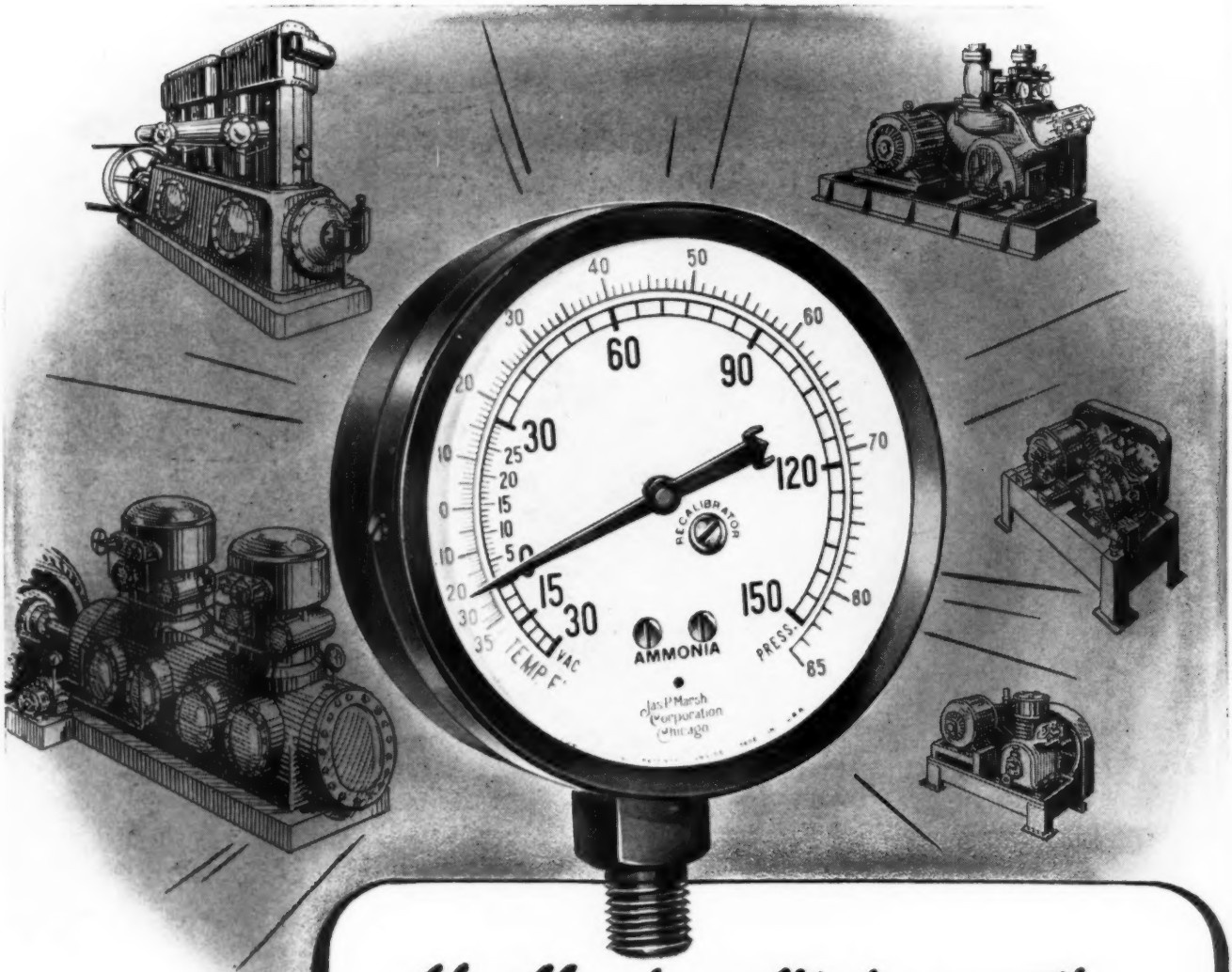
Name .....

Title .....

Company .....

Address .....

City ..... Zone ..... State .....



Yes, Marsh quality has won the **REFRIGERATION** *field, too—*

If you know Marsh quality, it won't surprise you to find that Marsh Pressure Gauges are preeminent in the refrigeration industry. The current census clearly shows that more manufacturers of refrigeration compressors equip their units with Marsh Gauges than any other make. And numbered among these users are the big names in this exacting industry where precision and stamina are a mandate.

You could ask for no higher testimonial to Marsh quality than this, yet Marsh Gauges have written a similar story into the records of every industry where pressure gauges are used. In the applications where the going is toughest — where the needs are most critical — Marsh is the gauge chosen by the most discriminative manufacturers to become a vital part of their equipment.*

Keep this in mind when you select pressure gauges—or equipment requiring gauges. Insist on the instrument that has proved first choice of industry for the most critical services.

Jas. P. Marsh products include: A full line and range of gauges in pressure, compound, altitude, hydraulic, sprinkler, ammonia, ounce-graduated retard, test, and diaphragm types. Dial thermometers in rigid stem and remote reading types. *Ask for literature.*

JAS. P. MARSH CORP., 2025 Southport Avenue, Chicago 14, Illinois
Export Dept.: 155 E. 44th St., New York 17, N. Y.

MARSH GAUGES

"THE STANDARD OF ACCURACY"

MARSH ALONE HAS THE "RECALIBRATOR"

. . . quickest and best way to correct a gauge that has been knocked out of adjustment by improper handling.

*One of a series of advertisements citing examples of this.

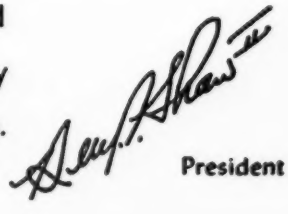
whatever your piping needs-

KNOWN SINCE 1893 FOR HIGH-QUALITY DEPENDABLE PRE-FABRICATION AND INSTALLATION

shaw

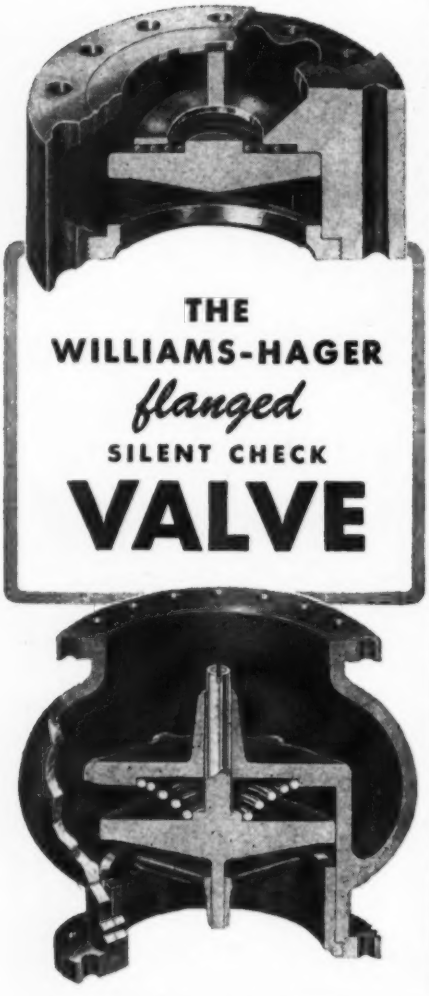
fills them quickly—dependably

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.



President

BENJAMIN F. SHAW COMPANY—2ND & LOMBARD STS., WILMINGTON, DEL.



THE
WILLIAMS-HAGER
flanged
SILENT CHECK
VALVE

..Corrects WATER HAMMER
for the most difficult
INDUSTRIAL—POWER—
BUILDING APPLICATIONS

The WILLIAMS-HAGER SILENT CHECK VALVE is furnished with Bodies of Iron, Semi-Steel, Cast Steel, Government Bronze, Stainless Steel or Monel Metal. They are fitted with Seats and Discs of either Government Bronze, Stainless Steel or Monel Metal. It is built in all sizes beginning with One (1) Inch and progressing through regular pipe line sizes to 20 Inches, inclusive, for all pressures up to 6,000 lbs. and for any temperature. It will handle all liquids, hot or cold—water, oil, gasoline, acids, chemicals, gas, air, salt water, brine, or other liquids.

Write for new bulletin!

THE WILLIAMS GAUGE CO.

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns

2055 PENNSYLVANIA AVE. · PITTSBURGH (12), PA.

Power News

(*Continued from page* 142)

Pittsburgh Co Plans Coal Gasification Plant

Pittsburgh Consolidation Coal Co announces plans for a research and development program that it is believed will lead to creation of a new multi-million dollar fuel industry. Aim of this program is to perfect commercial processes for making gasoline and a gas fuel of high heat value from bituminous coal. Commercial gasification and liquefication plants costing as much as $120,000,000 per unit may result from this project.

In explaining the company's plans for pushing this development, George H Love, president, said:

"A program of this magnitude requires careful analysis and long-range planning of the major steps involved. It can be said that step number one has already been taken. This covered the original survey and the fundamental laboratory studies and blueprinting of a pilot plant for the gasification of coal."

"The second step, which we are about to take at this time, is the construction of the pilot plant. Following a year or more of experimental operation of the small-scale plant will come the preparation of plans for financing the large commercial project. This might be done as a joint undertaking by industries closely interested in such an operation, or through some form of public financing."

"The final step," Mr Love said, "would be the construction and eventual operation of the commercial plant."

The revolutionary program is being pushed in collaboration with Standard Oil Development Co, central technical organization of Standard Oil Co (N. J.), which has an extensive background of research on this and related subjects. Arrangements have also been made to contribute to the studies of Hydrocarbon Research, Inc, headed by P C Keith, which is also engaged in research on gasification and liquefication of coal.

DEMONSTRATION-SIZE PLANT

Joseph Pursglove Jr, vice-president in charge of research and development, reports that the pilot plant will be of "demonstration size" and will be used to perfect and commercialize processes that are already under development on a laboratory scale. It will be erected at Library, Pa., near the company's newly organized research center. "We estimate its cost at $300,000," the research official said. "The pilot plant will consume about 50 tons of coal a day, and from this will come a daily production of about 2,400,000 cu ft of gas suitable for synthesis into liquid fuels and into a gas fuel of high heat value."

"A commercial plant for making liquid fuels and a high Btu gas, which we hope might be ready for operation by 1950-1951, could be located within some 25

A MERCOID
UNFAILING ADVANTAGE

Whatever your control requirements may be, it is conceded that the switch in a control warrants first consideration, due to its functional characteristics. All Mercoid Controls are equipped exclusively with hermetically sealed mercury switches of special design and selected materials.

Mercoid mercury switches are known the world over for their dependable service. They are not affected by dust, dirt or corrosion; nor are they subject to open arcing with its attendant consequences of pitting, sticking or oxidized contact surfaces, all of which, are likely to interfere with normal switch operation.

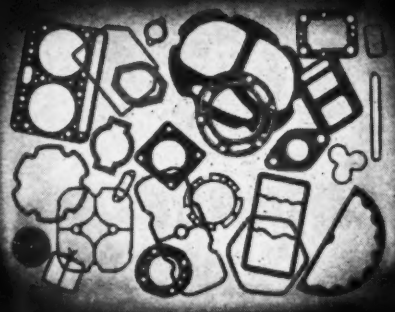
That is why among other things, Mercoid Controls on the whole give you assurance of better control performance and longer control life—a distinct and unfailing advantage—the reason why they are also the choice of America's leading engineers for many important industrial applications.

MERCOID CONTROLS are available in a variety of types for sensitive control of Pressure, Temperature and Lever actuation.

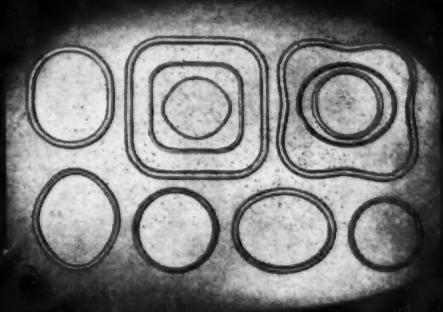
MERCOID
APPROVED CONTROLS

THE MERCOID CORPORATION
4201 BELMONT AVENUE • CHICAGO, ILLINOIS

Seamless Asbestos Man hole and Hand hole.



Special Metal Odd Shaped Gaskets.



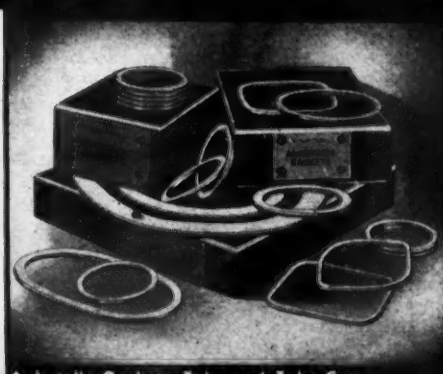
Steel Armored Tube and Tube Cap.

Folded Woven Hand hole and Man hole. 600

THE ANCHOR PACKING CO.

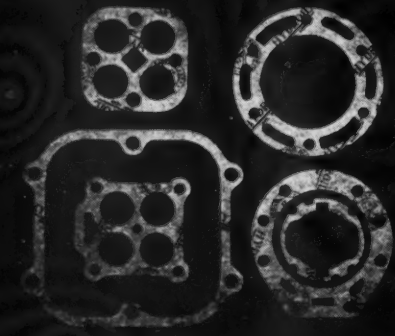
GASKETS

FOR EVERY INDUSTRIAL PURPOSE



Ankotalic Gaskets. Tube and Tube Cap.

Gasket Tape Woven.



Cut Hydroil.

Corrugated Asbestos Filled Gaskets. Copper, Steel, Monel Metal, Etc.

BOILER GASKETS

oven Asbestos Gaskets to fit practi-
ally every boiler made.

GASKETS CUT FROM SHEETS

Our gasket factory is prepared to supply gaskets of any shape, cut from a wide variety of gasket sheets to meet any requirements.

SPECIAL METAL GASKETS

Furnished to meet any special gasket problem.

Convenient Warehouse Locations with stocks for immediate shipment

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2207 1st Avenue South . . . . . Seattle 4, Washington
1407 Pine Street . . . . . St. Louis 3, Missouri
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524 Avalon Boulevard . . . . . Wilmington, California

HARD FACTS
for Practical Engineers
about the
PREFERRED UNIT STEAM GENERATOR

Here are some facts about the Preferred Unit Steam Generator that offer real food for thought to any engineer who's thinking of replacing or adding to his present boiler room equipment.

THE PREFERRED UNIT STEAM GENERATOR IS . . .

a heavy-duty, self-contained, oil-fired, portable steam plant embodying in one compact unit, all the equipment necessary to generate steam economically.

THE PREFERRED UNIT STEAM GENERATOR HAS . . .

- **Induced (Pull-through) Draft,** a distinctive feature, eliminating the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.
- **Fully Automatic Operation** even with Bunker C, No. 6, including the new catalytic residuals.
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miles of Pittsburgh, adjacent to one of the company's huge coal tracts. One single large plant of the size being considered could yield a gas of high heat value in quantities equal to the output of the Big Inch and Little Inch pipelines and create a local source of gasoline, diesel and other fuel oils and a certain amount of alcohols."

Mr Pursglove pointed out that production of coal in western Pennsylvania has been declining. This is because the industry here "cannot compete successfully in many cases with coals from neighboring states where they can mine coal more easily and at a lower cost. Apparently, one of the answers for continued coal production in western Pennsylvania on any scale approaching past years is to take advantage of its location close to large consuming markets and large areas of dense population by getting the coal into some form of energy that this large population can and will use locally.

"After it is done experimentally (and it has been done in laboratory-scale pilot plants) it must then be done on an economical, commercial basis so that these coal-made products can compete with petroleum-produced gasoline and natural gas."

"Research and development problems of this magnitude are so expensive that no coal company in this country, up to 1945, was willing or able to take on a job so big and naturally so speculative. Until the merger of Pittsburgh Coal and Consolidation Coal took place, this research project was too big to handle."

Mr Pursglove revealed the process consists of two basic steps:

"First, the coal must be gasified, that is, made into carbon monoxide and hydrogen. This produces what we call a 'synthesis gas' or 'feed gas,' which is similar to the old water gas first produced in the 19th century. This feed gas is put into what is called a hydrocarbon synthesis plant that will put the two together, forming a certain proportion of liquid fuels and a certain amount of gas of high heat value. The feed gas contains only about 300 Btu's per cu ft and no one yet has been able to make a high heat value gas that can compete with natural gas out of coal without first going through this synthesis conversion."

"Now, the conversion of carbon monoxide and hydrogen into gas fuel of high-Btu value and into liquid fuels has been done in a large-scale plant of Standard Oil Development Co at Baton Rouge, La. In this plant the starting material is natural gas, and it must first be broken down into carbon monoxide and hydrogen."

Engineers' Council for Professional Development, 29 W 39th St, New York 18, N. Y., recently published their Fourteenth Annual Report. It shows the advance being made by ECPD, indicated in the details of reports from chairman of ECPD and from the committees. Expanded activities are noticeable and extension of measurement and guidance project in engineering education is revealed. Also, this report inaugurates program of accrediting technical institutes.

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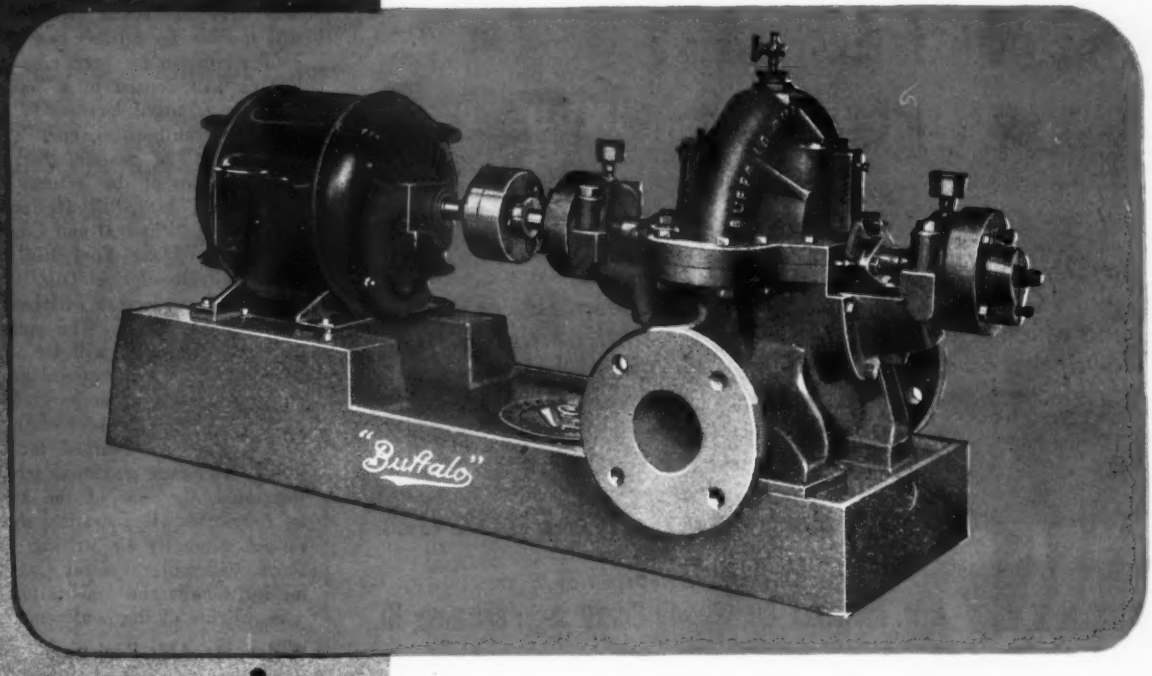
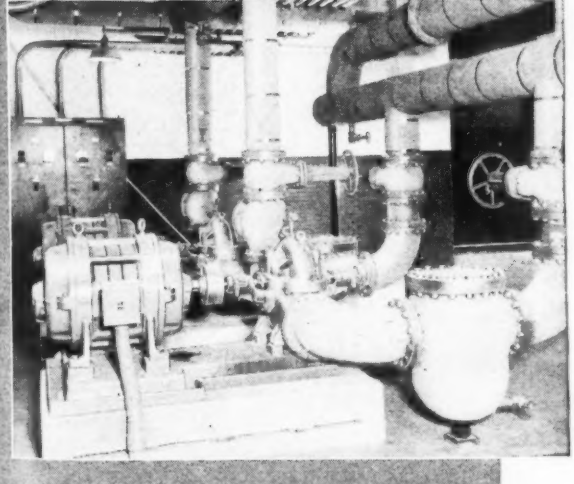


"Buffalo"



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The kind of hydraulic balance that means continuous service efficiency! Used all over the world for jobs up to 10,000 gpm, "Buffalo" Double Suction Single Stage Pumps have set long-life records exceeding even user's expectations. That's because all Buffalo Pumps have been engineered with plenty of metal in the right places . . . with extra deep stuffing boxes . . . with extra sturdy shafts . . . bearings that resist wear!

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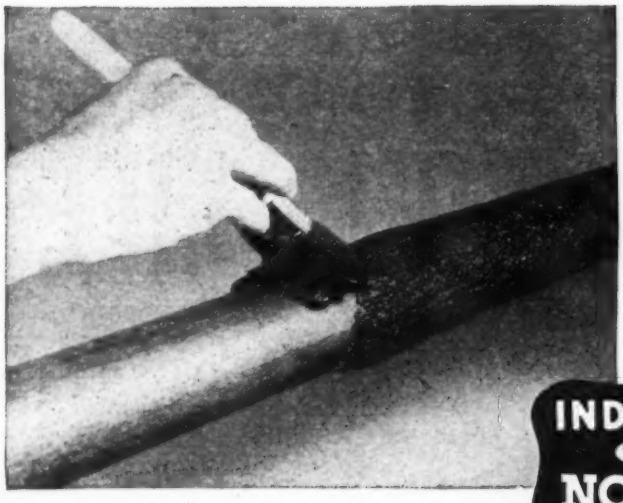
"Buffalo" **DOUBLE SUCTION PUMPS**



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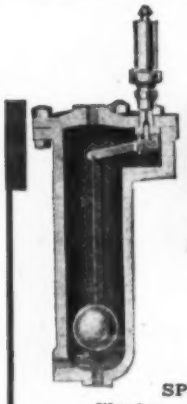

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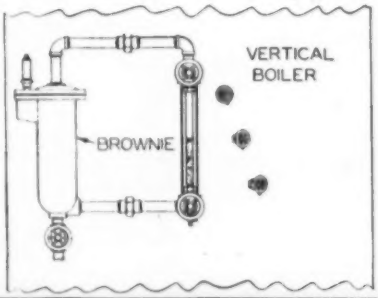
Protects Small Boilers

SPECIFICATIONS

Weight	17 lbs.
Pipe connection	1/2"
Bottom to top of cover	12"
Bottom to top of Whistle	18"
Steam Pressure	5 to 150 psi.



Simple to install and effective in operation, a "Brownie" is also inexpensive protection against the danger of low water level remaining unnoticed.

Note in the diagram how easily it is connected to the water gauge fittings. Note also that the "Brownie," because of its lightness, needs no bracket to support it.

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ASME Announces Oil and Gas Power Conference

Final plans for its 19th annual conference, to be held at Cleveland on May 21-24, have been completed by executive committee of the oil and gas power div of American Society of Mechanical Engineers, of which Lee Schneitter is chairman. In addition to the customary technical sessions, manufacturers' exhibits, plant-inspection trips and social events, the division will sponsor an entirely new idea in technical education for practicing engineers.

This will consist of a series of three specially arranged lectures to be given by recognized authorities, each an expert in his field. The general theme is *Diesel Fuels.* Titles of the lectures in order of presentation are: "Production of Diesel Fuel Oils"; "Physical and Chemical Characteristics of Diesel Fuel Oils"; and "Combustion of Diesel Fuel Oils."

Each 2-hour lecture will be followed by informal discussion. The entire day and evening of May 20 will be used for this purpose. Those who attend are invited to remain for the regular part of the annual conference for remainder of the week.

A fee will be charged for the lecture series. To assure maximum service to those interested, the size of the audience will be restricted. Registration should be arranged promptly by writing to W L H Doyle, Caterpillar Tractor Co., Peoria, Ill., for full details and registration card.

Highlights of the conference:

Wednesday, AM: Registration

May 21 PM: Technical Session—three papers:
Suggestions on Use of Internal-Combustion Engines in Locomotives
Some Aspects of Fuel Injection for Aircraft Engines
Test Results of Internally Cooled Supercharging

Thursday, AM: Technical Session — two papers:
May 22 *Diesel Fuel Oil Supply Situation*
Comparison of Various Vegetable Oils as Fuels for Compression-Ignition Engines
PM: Plant inspection trips

Friday, AM: Technical Session — two papers:
May 23 *Sleeve Bearing Design Fundamentals for Diesel Applications*
Large Bearing Design, Application and Operation
PM: Plant inspection trips

Saturday, AM: Technical Session — two papers:
May 24 *Diesel Engine Bearings Behaviorism of Aluminum Alloy Bearings in Diesel Engines*

Inspection trips to plants of Cleveland

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POWER PLANTS . . . cut costs with CLARK STEAM TRAPS. Large volume air removal gives quicker heating up action—saves fuel. Elimination of condensate permits rapid, full flow of new dry, live steam—extends life of equipment.

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fluid controls made by Clark have been saving fuel and increasing equipment efficiency wherever steam, air or gas are used.

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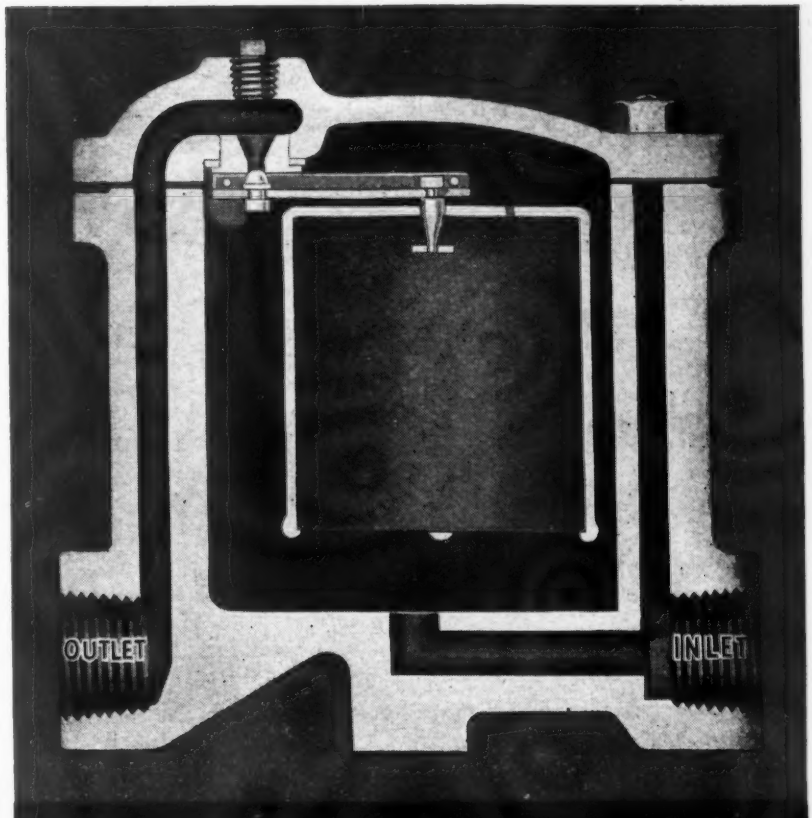
- **Breweries**
- **Chemical Plants**
- **General Industry**



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STEAM AND FLUID TRAPS	STRAINERS	PRESSURE REGULATORS
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Delivers the
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With a Henszey Boiler Feed Regulator controlling the "life line" to your boiler, you help avoid burned out tubes, cracked headers, or even the serious explosions that can result from low water levels.

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also guard against high water hazards by maintaining proper boiler water levels continuously, automatically, accurately under all conditions. These compact, self contained units go right into the line without additional supports. Once installed, they need no further attention — nothing to get out of order — nothing to rust. Made for pressures up to 600 lbs. and in sizes up to 4 inches. Now is the time to get more facts on low cost, accurate boiler level control. Send for bulletin or contact your nearest Henszey representative.

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diesel div of General Motors, Cleveland Graphite Bronze, Aluminum Co of America and National Advisory Committee for Aeronautics, are to be scheduled so interested engineers can visit all four plants during the two afternoons reserved for this activity.

Social events include a luncheon on opening day, Wednesday, May 20; a buffet supper and social hour Wednesday evening; an exhibitors' social hour Thursday noon; and the banquet, on Thursday evening, at which George Codrington, honorary chairman, will preside.

Those planning to attend the special lectures or the conference itself are cautioned to reserve hotel rooms at their earliest convenience. This may be done by corresponding directly with Hotel Statler, Cleveland, Ohio, the official conference headquarters. Reference to the conference will secure a prompt response from the hotel staff.

The Atom in Peacetime is an exhibit that will be the keynote feature of the Mid-America Exposition of 1947, at Cleveland, Ohio, May 22-31. This exhibit depicts benefits arising from research and development of atomic power to American industry and our daily life. With guidance and cooperation of Atomic Energy Commission, Washington, D. C., this atomic power exhibit will be the first comprehensive display of scientific, engineering and industrial development in field of commercial applications, since the advent of the atom bomb. In addition to the Mid-America Exposition, Inc, and the Atomic Energy Commission, other groups and individuals taking part in the presentation include the Kellex Corp, div of M W Kellogg Co, and Dr J R Dunning, of Columbia University. Kellex Corp is working on development of atomic fission for commercial purposes.

An intensive one-week educational conference for college and university professors who teach courses in diesel engineering has been announced by Diesel Engine Manufacturers Association. The conference is the first of its kind ever to be given. During June 23-27, 50 professors from all sections of the country will headquarter at Chicago's Hotel LaSalle. They will follow a program that includes visits to engineering laboratories of Illinois Institute of Technology and Northwestern University, and factory tours of General Motors plant at LaGrange and International Harvester Co in Chicago. Supplementing these inspection tours will be classroom talks on various diesel-engine topics. No entrance fee will be charged for the course, but the enrollment will be limited to 50. Applications will be handled in the order they are received.

The 1946 Lamme Medal of American Institute of Electrical Engineers has been awarded to John B MacNeill, manager of switchgear and control div of Westinghouse Electric Corp, for his foresight, leadership and creative contribution in development of switching equipment. The medal will be presented at summer meeting of the Institute, in Montreal, Que., June 9-13.

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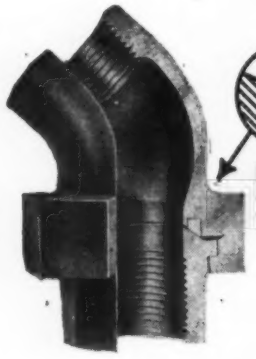

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Jefferson Specialty Unions with the Recessed Brass Seat are made in all types for all piping needs. The 45° Union Elbow illustrated is typical of the complete line. Thus it is possible through the use of Jefferson Unions to standardize on unions of utmost dependability.

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Every engineer believes that conditions in his boiler room are different. "That stuff might work for the other fellow. Won't be any good here." Maybe so. But we have yet to see the heating system fouled with sludge that NCC won't clean and keep clean. And we know because once an engineer tries NCC, he keeps on buying it. Want proof—technical bulletins, users' experience? It's yours on request.

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Detroit Edison Plans Construction Program

Detroit Edison Co announces a 4-year construction program that calls for expenditure of $96,000,000 to increase power-producing capacity of the system by 22.4%. Expenditures for 1947 will approximate $20,000,000.

Out of the $20,000,000 comes the final payment on a 75,000-kw turbine-generator at the Marysville plant which was put into operation Feb 14. Out of that sum also will come the first payment on installation of two 100,000-kw turbine-generators at the Trenton Channel plant. The first of these is scheduled to go into service in 1949. Their total cost, with housing, boilers, stacks and other necessary equipment, will be from $26,000,000 to $30,000,000.

The job must be done because of expected electrical growth in Detroit metropolitan area. Detroit Edison's total power output in 1946 was 2½% over 1945 production. Twice in Dec the output hit an all-time high, exceeding heaviest requirements of war days when industrial plants were running around the clock.

Two turbine-generators to be installed at Trenton Channel will be the largest of any in the company's four power plants. When operating at full load each of these turbines will require 900,000 lb of high-pressure, high-temperature steam per hr. To generate this steam the boilers will use 1000 tons of coal per day. About 400,000 tons of water a day will be required for condensing purposes. Each generator will produce enough electricity to meet residential, commercial and industrial needs of average city of 200,000 population.

About 650 men are now employed in the company's field construction force and 200 more will be added in 1947. Probably another 650 will be added in 1948.

Charles Benjamin, chief engineer of Biddeford steam plant of Central Maine Power Co, and Thomas Caddigan, boiler operator at this station, were guests of honor at a recent dinner in connection with their retirement. Mr Benjamin was employed by Pepperell Mfg Co, Biddeford, from 1901 to 1916, the last six years as chief boiler-room engineer, and then joined the predecessor of Central Maine Power Co, Cumberland County Power & Light Co, as top man at the Biddeford station. Mr. Caddigan entered the company's service in 1929.

Meeting in Cleveland on March 7, leaders of important segments of heating, ventilating and air-conditioning industry unanimously voted that American Society of Heating and Ventilating Engineers should undertake correlation and coordination of research of radiant panel heating. Distributed to all persons attending the panel heating conference was a bibliography of more than 120 references to published information on panel heating, prepared by the laboratory staff. A copy may be had by writing the ASHVE Research Laboratory, 7218 Euclid Ave, Cleveland 3, Ohio.

Salt of the Earth!

...Compressors and Blowers

SALT? Yes, like salt to the human body, air and gas compressors, and turbo-blowers are essential to modern industry.

THE EARTH? Serving on *land* and *sea* all over the earth you'll find hundreds of thousands of many types of I-R Compressors and Turbo-Blowers.

SALT OF THE EARTH? By that we mean the best in *quality*... quality that a manufacturer builds into the machine to assure lower-cost operation, greater dependability, and longer life.

Ingersoll-Rand has always endeavored to design and build the best compressors and turbo-blowers in the world, to properly apply each machine to its job, and to make sure that each compressor meets the conditions for which it is sold. These are good reasons for consulting Ingersoll-Rand the next time you have a problem of compressing air or gas. There is a branch office near you.

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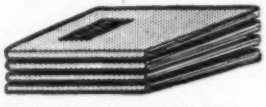
INCREASE PRODUCTION EFFICIENCY
IMPROVE QUALITY OF PRODUCTS

If you use steam for industrial processing, the advantages of Stickle Control and Drainage Equipment will interest you. Stickle Equipment affords economy, efficiency and improved quality of products or services in a broad segment of industry such as plants in the food, textile, paper, chemical and laundry fields.

Stickle Feed Water Heater Bulletin No. 117. Fully illustrates types, sizes, construction.

Bulletin No. 235: Complete data on Series 200, Double-seated, Semi-balanced Valves. Bulletin No. 435: Describing Series 400, Single-seated, Balanced Valves.

Bulletin No. 501: Series 500 Stickle Temperature Control Valves, for control of temperatures in industrial processing.



Stickle Steam Traps. Bulletin No. 115: Series 100 for small capacities, medium to high pressures. Bulletin No. 315: Series A E, for larger capacities, medium to high pressures. Bulletin No. 515: Series 50 for large capacities at high pressures. Bulletin No. 415: Series T for low to medium pressures and for vacuum service.

Stickle Differential Drainage and Boiler Return System increases boiler capacity, saves fuel. A closed pumping system. Ask for Bulletin No. 250.

Stickle Triplex Oil and Steam Separators—horizontal and vertical types. Ask for Bulletin No. 200.

PURIFIED AND HEATED FEED WATER

Stickle service starts in the boiler room—with Stickle Open Coil Feed Water heaters. Stickle Open Coil construction permits raw make-up water to be brought into direct contact with steam. This not only gives heaters superior heating capacity, but assures fully one-sixth of boiler feed to be composed of condensed steam, free of impurities. Simplicity of construction reduces attention and makes maintenance negligible.

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Stickle Valves supply a control that makes for maximum operating efficiency. These valves are made especially to handle complicated pressure regulation in fields of service where extremely close limits are essential. In addition to exactness and dependability of construction, each valve is "tailored" to meet specific use and operating conditions. Double-seated, semi-balanced. Single-seated, balanced. Self-contained. Pilot operated.

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Stickle Steam Traps supply rapid removal of condensate—continuously. The Stickle Open Float principle assures a natural positive action—eliminates all troublesome internal mechanism. It is basic to four series of traps designed to meet all drainage requirements. Stickle Differential Drainage and Boiler Return System pumps condensate to boiler, under pressure, at temperature only slightly lower than that at which it leaves traps.

Bulletins listed above supply full information and engineering data on various series of Stickle Specialties. Mailed on request.

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Shanghai Plans Centralized Station

SHANGHAI (*McGraw-Hill World News*): Calculating that Shanghai will need an increased generating capacity of 320,000 kw at the end of 1951, T C Tsao, commissioner of Public Utilities Bureau of Shanghai, is laying plans for installation of a centralized power station along the Whangpoo River. In organization the new plant will act as a "super" power pool, to provide needed electricity to existing companies.

This would preclude expansion of such companies as Shanghai Power Co but would not prevent their rebuilding to prewar size. Existing companies would buy power from the central plant when demand exceeds their own generating capacity.

The new company would not distribute to users, according to Commissioner Tsao's program. The only steps contemplated would be an integration of separate systems into a single power grid for Shanghai and outlying districts.

According to Ministry of Economic Affairs, transmission line voltage of such a system would be 33,000 v, with distribution line voltage of 6600 and terminal voltage of 380 and 220. Only the plant site has been selected and Commissioner Tsao does not know when construction will begin. Biggest stumbling block is finance, both internal and external. As a start, generating equipment with a capacity of 106,000 kw has been assigned to Shanghai from reparations now being made available in Japan.

Companies with previous generating equipment are the Shanghai Power Co, Chapei Water & Electric Co, Chinese Electric Co and Pootung Electric Co. Of these, Shanghai Power is the largest. A Sino-American distributor, Western District Power Co, would also come into the network.

As franchises of these companies expire, they may be purchased by the city for incorporation in a municipal-owned company. This question will not come up for several years. Shanghai Power Co's rights extend until Aug 7, 1969, French Power Co's until May 1, 1983, and Western District Power Co's until Dec 31, 1964.

HAVANA, CUBA (*McGraw-Hill World News*): Compania Cubana de Electricidad, which furnishes the bulk of electricity in Cuba, plans to spend $25,000,000 in the next six years to expand the generating capacity of its plants. This sum will be in addition to its regular construction budget. Present generating capacity of the plants is 129,542 kw.

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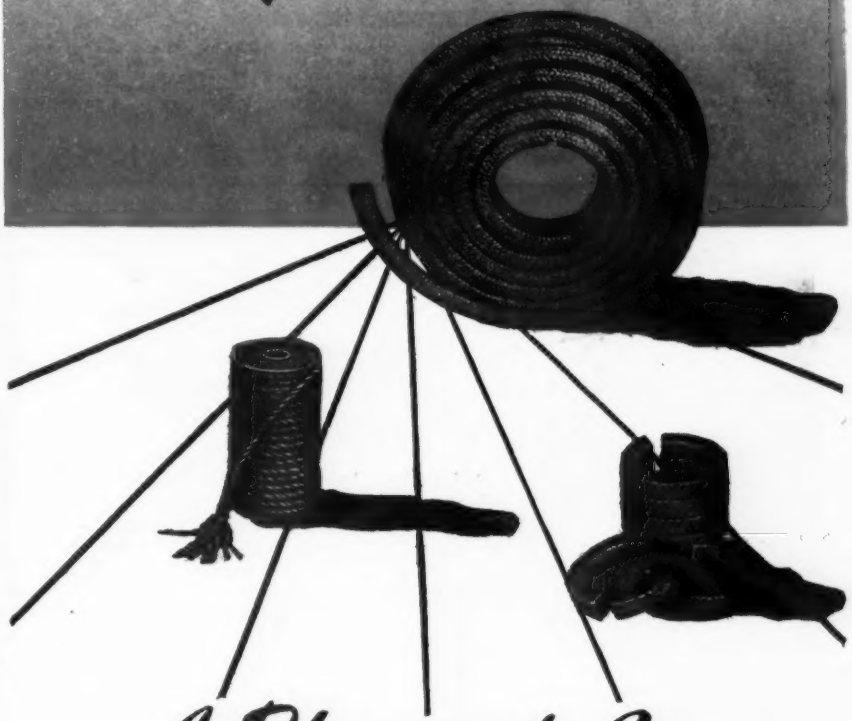
Greene, Tweed & Co., manufacturers of famous Palmetto Asbestos products, are pleased to announce that Palmetto Asbestos Safety Clothing is again available. To meet the demands for many new types of gloves, mittens, aprons, coats and other garments, the line of standard products is now far more comprehensive than that which existed before the war.

Illustrated above are a few representative products. For literature covering the entire line or particulars on special safety clothing, write Department "S"—Greene, Tweed & Co., North Wales, Pa.

PALMETTO *Pelro*



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Canadian white asbestos strands *individually* impregnated with an exclusive lubricant is Palmetto Pelro's success secret. This wonder lubricant resists the solvent attack of chlorinated hydrocarbons, petroleum solvents and coal tar derivatives. It sizes the asbestos yarn, positively stopping capillary seepage and reducing fire hazards.

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Stop Leaks Prevents Scoring

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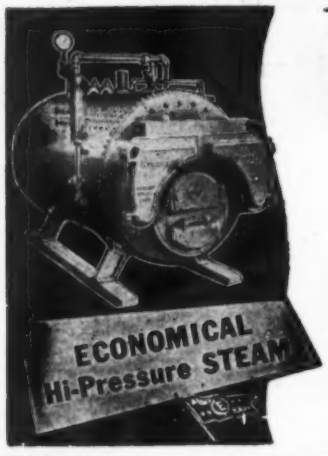


New, Small, 6 H. P. Size

KEWANEE

SCOTTIE JR BOILER

6 sizes for 6 to 30 H. P., 100 lbs. W. P. Low in first cost and economical to operate. Conveniently compact yet very accessible.

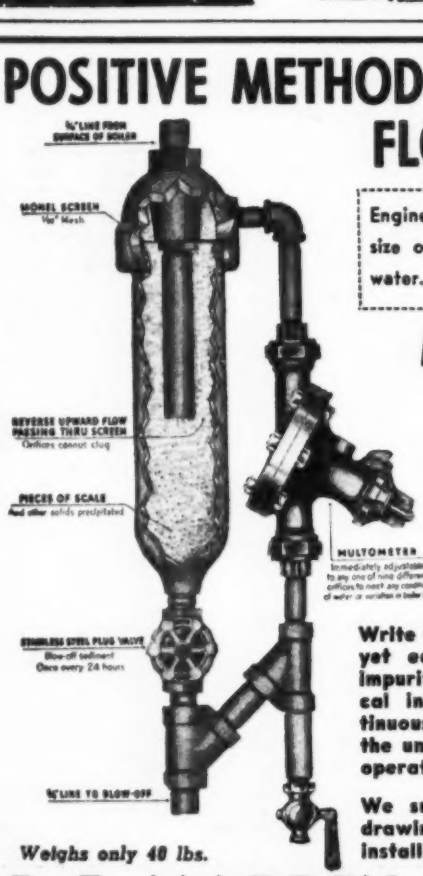
For 6" scale with pipe diameter markings . . . WRITE Dept. 99-K6

KEWANEE BOILER CORPORATION

KEWANEE, ILLINOIS

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

POSITIVE METHOD OF MEASURED FLOW CONTROL



Engineered for use with every kind and size of boiler and every character of feed water.

MULTOMETER SYSTEM

of Continuous Boiler Blow-off

The only continuous boiler blow-off which will neither cut out nor wear out in regular service.

Write for 6-page bulletin on this accurate, yet easy, way to control and remove impurities in boiler water. It shows typical installations of MULTOMETER Continuous Boiler Blow-off. Shows how easily the unit is installed and how effectively it operates.

We supply complete data and working drawings showing the best method of installation on various types of boilers.

Weighs only 40 lbs.

P. E. MADDEN & COMPANY

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Virginia Electric and Power Co board of directors gave its approval to a $14,750,000 program of construction in 1947. Largest single item in the budget is $3,000,000 for building of short-line extensions to connect 28,000 new customers. Another major item is the first year's construction cost toward a new 60,000-kw generating plant at Possum Point, on the Potomac River just across Quantico Creek from Quantico, two miles from Dumfries. The plant will be modeled after Vepco's newest power plant in Chesterfield County, but will be designed to produce full output on oil as well as coal. Except in emergency periods, however, the plant will burn coal. Total construction costs of the Possum Point plant are estimated at $10,000,000. Preliminary construction work, including the building of an access road and a railway spur, has already started.

Another $2,000,000 is provided for installation of a new boiler in the company's power plant in Norfolk. While this boiler is designed primarily to replace old boilers, it will serve to increase the plant's total output by 20,000 kw. Vepco's present generating capacity of 450,000 kw will be boosted about 15% by the combined Possum Point and Norfolk construction. Final major item is for expenditure of $2,200,000 for rural extensions in all parts of Vepco's Virginia and North Carolina territory.

A new electric-power plant that will eventually be the largest such facility in the Southwest has been approved for construction 10 miles west of Oklahoma City, Okla., by Oklahoma Gas & Electric Co. Ultimately, the plant will have a generating capacity of 150,000 kw. Construction plans call for installation of the first 50,000-kw generating unit along with the plant structure. The two units of similar capacity for subsequent addition will be installed as load requirements dictate. Initial outlay for the plant and primary generating equipment will be $6,000,000. Subsequent additions will cost $3,000,000, or an ultimate total of $9,000,000. The new Oklahoma City plant site is on North Canadian River and will be served by Rock Island Railroad.

South Carolina Power Co will spend about $6,000,000 during the next two years in its expansion and improvement program, according to President E L Godshalk. Of this amount, the company will spend about $4,400,000 this year and $1,600,000 in 1948.

Southern California Edison Co will spend some $52,000,000 for construction during 1947, W C Mullendore, president, announced. Construction program includes completion of the first two units of the new Edison steam electric generating station at Redondo Beach, which will add 120,000-kw capacity, and additions to the Big Creek hydroelectric generating system for another 35,000 kw. Two new major 220,000-v substations, one near Springville and one near Monterey Park, and 36 new transmission and distribution substations will be constructed. Additions to transformer capacity will be made in many existing substations in the 1947 program.

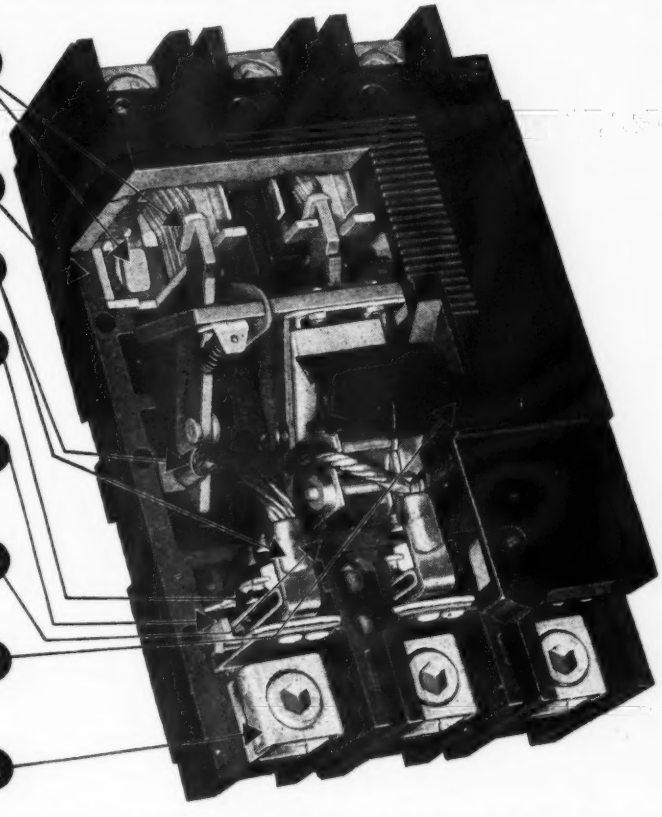
A PART OF SQUARE D's PARADE OF NEW DESIGNS

NEW

COMPACT (10 3/8" x 6") 225 AMPERE FRAME TYPE ML3 CIRCUIT BREAKER

ML line of Circuit Breakers now extended to include 225 amperes

1. Contacts are non-welding, silver composition mounted on copper alloy contact arm and terminal.
2. Mechanism sealed in bakelite case.
3. All connections welded or silver-brazed.
4. Thermal overcurrent elements trip breaker on sustained or heavy overload.
5. Magnetic elements trip breaker instantly on higher than normal overloads.
6. Bakelite trip bar actuated by overcurrent elements to trip breaker.
7. Automatic Tripping clearly indicated by intermediate handle position.
8. Special Solderless lugs with hinged tops.



Dust-resisting Enclosure

Distribution Panel

Similar in design and features to the ML2, 100 ampere frame circuit breaker, this new quick-make and quick-break, Type ML3, 225 ampere frame is available in distribution panelboards, switchboards, and in dust-resisting enclosures.

Trip ratings 125 to 225 amperes. Voltages 125-250 volts AC. 600 volts AC. 250 volts DC.

Write for Bulletin 3600 which gives complete details of both the ML2 and ML3. Address Square D Company, 6060 Rivard St., Detroit 11, Michigan.

SQUARE D COMPANY

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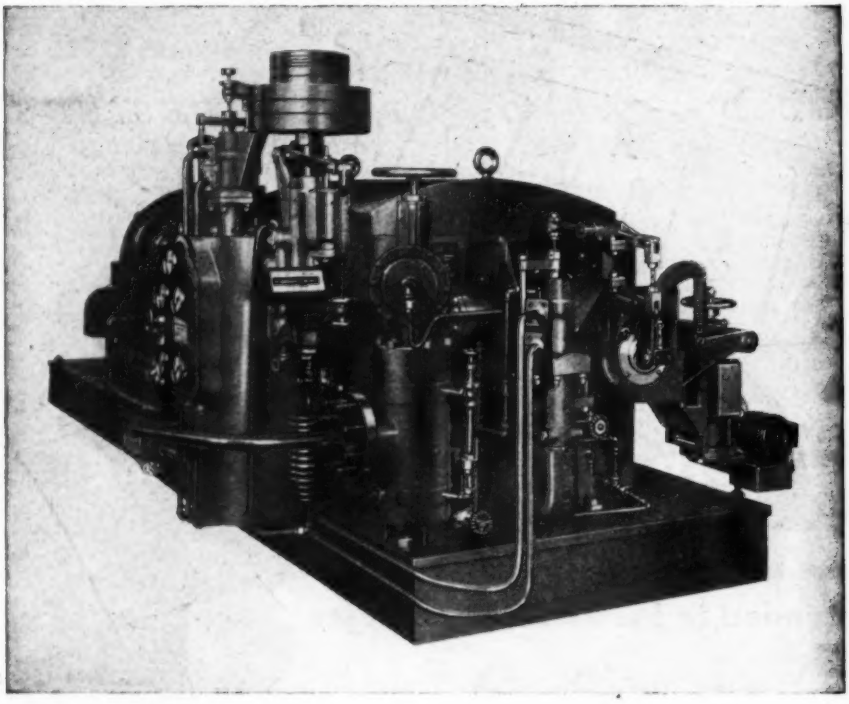

LARGE TURBINE PERFORMANCE FOR THE SMALL PLANT

An outstanding advantage of Murray Turbines is that they give the small plant many of the desirable operating economies enjoyed by larger plants.

The illustration above shows a typical job of this kind—a 175 KW Murray Extraction Turbine installed in a midwestern packing plant.

This modern unit operates with steam at 235 lb. pressure—500 deg. F. total temperature, and exhausts at 27 in. vacuum. Steam is extracted automatically at 60 lb. pressure.

Let our engineers cooperate in smoothing out your power problems.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

Federal Power Commission has received an application from Pacific Gas & Electric Co of San Francisco, Calif., for a license to construct two hydroelectric projects on North Fork of Feather River in Butte and Plumas Counties, Calif. Projects would be known as Rock Creek and Cresta Projects and are part of a scheme of development planned to utilize the power potential of the head of North Fork of the Feather between Lake Almanor and intake to Big Bend Plant. Construction is proposed to begin in June 1947 on Cresta Project and in June 1948 on Rock Creek.

Rock Creek Project includes a concrete diversion dam across North Fork, a powerhouse with two 73,500-hp turbines each connected to a 63,000-kva generator, a substation, a switchyard, two transmission lines about 500 ft long, water conduits and appurtenant equipment. The dam would be about 115 ft high and 550 ft long.

Plans for Cresta Project include a diversion dam on North Fork below the Rock Creek Dam, water conduits, a powerhouse equipped with two 46,500-hp turbines each connected with a 37,500-kva generator, substation, switchyard and transmission lines. The dam would be about 113 ft high and about 360 ft long. Maximum elevation of the dam will be 1680 ft with normal operating water surface level at elevation 1670 ft.

Central Maine Power Co directors have approved an appropriation of $3,700,000 for redevelopment of a hydroelectric plant on a site owned by the company at Union Falls on the Saco River, about 8 miles from Biddeford. Two 8400-kw units have been ordered, each consisting of a General Electric generator driven by an S Morgan Smith turbine. It is estimated that the new installation will yield about 75 million additional kwhr annually and enable the Saco River flow to be more efficiently utilized. Present installation is rated at about 812 kva. Many engineering details remain to be worked out, but the project will be a valuable addition to the company's generating facilities in southern Maine.

Public Service & Gas Co authorized construction of a third 100,000-kw generating unit for installation in its new Sewaren generating station to meet the peak load forecast for 1950. The new installation, estimated at $12,000,000, brings to $38,000,000 the total cost of the new generating station.

Construction work is now under way on initial step in the project, which includes two 100,000-kw units scheduled for operation in fall of 1948. Newly authorized equipment will be similar in design to that which has been purchased for first two units. It will include a 100,000-kw high-pressure high-temperature turbine, with a semi-outdoor boiler, and necessary auxiliary apparatus, and transformers and electrical equipment for making the generator output available on the 132,000-v transmission system. Because of abnormally long delivery schedules now required for all major apparatus, construction work is being released at an unusually early date, to assure completion of the installation in ample time to meet load requirement.

Mystic Maze

(Isotherm Adsorption Apparatus)

Seen through this mystic maze of tubes and wiring is a Sinclair Research technician. What his apparatus means to users of industrial lubricants is no mystery, however.

At Sinclair Laboratories, the Isotherm Adsorption Apparatus is used constantly to determine the effectiveness of adsorbents used in lubricating oil refining procedures. Because Sinclair lubricants are made with infinite care to suit the specific requirements of your equipment, it is highly important to know exactly how adsorbents, catalysts, and other treating materials perform in a refining process.

This intricate apparatus is an assurance that Sinclair lubricant manufacture guarantees the very highest quality product. It is one more evidence of the painstaking Sinclair research and refinery control that result in outstanding lubricant performance.

Sinclair Power Plant Oils

For Turbines:

SINTURLITE OILS

Oxidation stability, rust prevention, long life

For Compressors:

RUBILENE OILS

In grades to suit all operating conditions

From selected crude processed to quality finish

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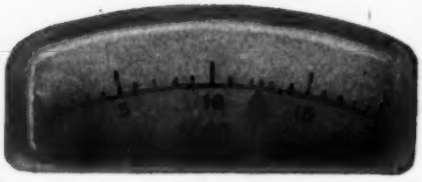
Lubricants for Industry

FINEST CRUDES + EXPERT RESEARCH and MANUFACTURING CONTROL = OUTSTANDING PERFORMANCE



STOP
HEAT LOSS by a
LOOK
at RANAREX*
LISTEN:

THERE'S no time lag with Ranarex, while precious heat goes up the stack. This *mechanical* CO_2 indicator and recorder gives you constant, instant readings–accurate to within 3/10 of 1%!

Users report Ranarex saves them as much as 20% on up-the-stack heat loss. You'll find big savings, too, with this rugged, dependable fuel-economizer.

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PERMUTIT'S
RANAREX
CUTS
UP-THE-STACK
HEAT LOSS

San Diego Gas & Electric Co has announced a $19,400,000 2-year construction program. Included in the largest building budget ever announced by the utility is $5,500,000 for completion of 50,000-kw generating unit now being installed at the company's Silver Gate plant; $2,900,000 for a new 66,000-v transmission network and substations to serve the county's suburban and rural areas; and nearly $10,000,000 for extension of service to new gas and electric customers, the installation of equipment to reinforce the existing distribution system and various buildings and improvements. The budget also calls for erection of a 10,000,000 cu ft natural-gas holder, which will be as large as any on the Pacific Coast, about 220 ft high by 276 ft in dia.

Plans of Appalachian Electric Power Co to build a $20,000,000 steam-electric power-generation station, on Ohio River near Graham Station, W. Va., were announced by M C Funk, vice-president and general manager of the company Work on the new plant was started in April and will be completed by the summer of 1949. The power station will have an initial capacity of 145,000 kw and will serve as an addition to present system facilities. Plant is to be owned jointly by Appalachian Electric Power Co and Ohio Power Co, both units in centrol system of American Gas and Electric Co. Plant will be known as the Philip Sporn plant.

Sterling Engine Co of Buffalo, N. Y., has received orders for 24 engines to be used for rehabilitation work in China under the UNRRA program. Seventeen of the engines are 6-cylinder Sterling Vikings having 8-in. bore and 9-in. stroke. Seven are 6-cylinder Sterling Petrels having 5½-in. bore and 6-in. stroke. These Sterling Viking and Petrel engines will be used in China to operate water pumps built by Buffalo Pumps, Inc, also of Buffalo. The Viking engines will drive pumps delivering 2500 to 3500 gal per min against a 200-ft head or at a pressure equivalent to 86.6 psi. The Petrel engines will deliver 1800 gal per min against a 270-ft head or at a pressure equivalent to 116.8 psi. Reconstruction of water-supply systems with Sterling powered pumping units will do much to alleviate famine and disease in war-torn China.

Michel-Cather, Inc, specialists in industrial advertising, sales promotion and public relations, have released a published research report in which they forecast $100 million will be spent annually for the air conditioning of industrial and commercial buildings beginning this year. Compiled under direction of J F Brinley, account executive for that firm, the 26-page report, *The Market for Air-Conditioning in Commercial and Industrial Buildings,* is based on a technical study of future markets for air conditioning of industrial buildings, hotels, restaurants, theaters, banks, hospitals, schools, department stores and other commercial establishments. Single copies may be secured without charge by business executives who write to J F Brinley at *Michel-Cather, Inc, 2 Park Ave, New York 16, N. Y.*

Before You Buy ANY Domestic Water System
See the PEERLESS Water King

Exclusive
Water King Features

SIMPLIFY WATER PUMPING–LOWER COSTS

THE MOST ADVANCED PUMPING PRINCIPLE IN THE LAST 10 YEARS

"Magic Wings to Water Lift"

The trouble-free simplicity of the patented Peerless Water King is a real innovation in water pumping. Here is the ideal pump for domestic and light industrial water systems, meeting every requirement for simplified pumping at lower costs.

The Peerless Water King is the pump with "Magic Wings to Water Lift." The Water King is a shallow well pump, embodying an exclusive "magic" pumping element: a hard chrome rotor revolving in a rubber stator that draws water upward and forces it into pressure tank–the most advanced pumping principle in the past 10 years. Capacities: 275 to 860 g.p.h., against pressures up to 40 lbs. *There are no parts of the pump underground.* 100% automatic. Easily installed over the well or offset. Pumping element highly resistant to abrasive and corrosive action. Finely engineered–Compact–Quiet–Trouble-free.

The Peerless Water King

Covered by Peerless Patent 2,346,428
Mfd. under R. Moineau's U. S. Letters Patents 1,892,217-2,028,407 — Reissue 21,374 and Canadian Patent 352,574; Robbins & Myers, Inc., Sole U. S. and Canadian Licensee.

PLAN WITH PEERLESS

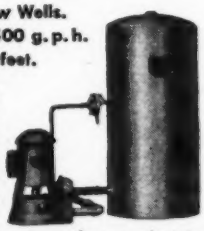
Peerless has a pump for all your needs for water–from 10 to 220,000 gallons per minute! Write to Peerless factory or district office for literature and name of nearest dealer.

Descriptive Bulletins available.

2 PEERLESS DOMESTIC WATER SYSTEMS

A PEERLESS JET SYSTEM, TOO

For Deep or Shallow Wells.
Capacities: 120 to 7500 g. p. h.
Lifts up to 120 feet.



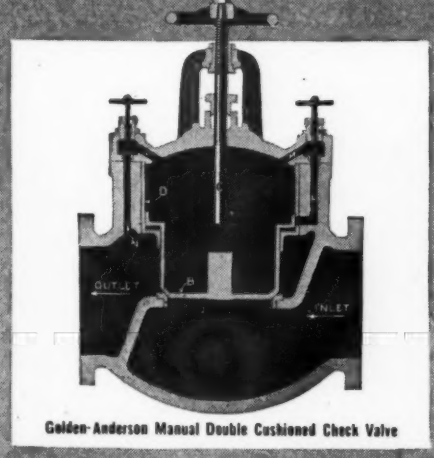
This amazingly simple and compact Peerless Jet Water System produces all the water you want for normal light industrial operating requirements. It is a pressure system, entirely automatic, and occupies little more space than an electric motor. A Peerless Jet Water System offers a lifetime of trouble-free water service at minimum cost. Can be installed over well or offset. Write for Bulletin B-155-1 describing Jet Water System in detail.

PEERLESS PUMP DIVISION
Food Machinery Corporation
Factories
Canton 6, Ohio — Quincy, Ill
Los Angeles 31, Calif.
District Offices
Canton 2, Ohio; Ardmore, Pa.; Decatur, Ga.; Dallas 1, Texas

Golden-Anderson Standard Double Cushioned Check Valve

Golden-Anderson Double Cushioned Check Valve

Golden-Anderson Manual Combination Check Valve



Golden-Anderson Manual Double Cushioned Check Valve

THOUSANDS OF SAFE

"STOPS and STARTS"

day after day

hydraulic... automatic... manual

GOLDEN-ANDERSON

CUSHIONED

CHECK VALVES

Designed for safe, dependable control on the most difficult installation to eliminate serious surge and "Water Hammer"—to properly arrest reverse flow. GOLDEN-ANDERSON Cushioned Check Valves are specified on many of the most important new and replacement installations.

Write for informative technical catalog.

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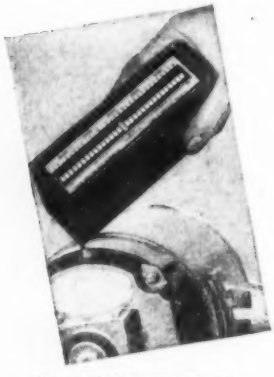
VALVE Specialty Company

KEENAN BUILDING · PITTSBURGH 22, PA.

"Jagabi" Hand Tachoscope
Bulletin 1790-P.

"Jagabi" Type "A" Universal Tachometer. *Bulletin 1795-P.*



"Frahm" Vibrating Reed Tachometer. *Bulletin 1810-P.*

Over the past 30 years the Biddle Company has been a source for precision speed measuring instruments that have consistently demonstrated superior quality, high accuracy and dependability in service. Carried in stock are a variety of types and ranges of instruments for measuring rotational and surface speeds, rates of vibration and speeds of totally enclosed machines . . . helpful in the solution of your engineering problems. We shall be pleased to quote on your needs. Send for literature today.

"Jagabi" Speed Indicator
Bulletin 1815-P.

Jones Heavy-Duty Tachometer
Bulletin 1710-P.

James G. **BIDDLE CO.**

ELECTRICAL & SCIENTIFIC INSTRUMENTS

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BOOKLETS

"Oil Purification, Filtration and Reclamation." *Vol XXXIII, No. 1, of "Lubrication," Jan,* 1947. *12 pp, illustrations, charts. Available on request to Texas Co,* 135 *E 42nd St, New York* 17, *N. Y.* This issue of the magazine presents characteristics of used oils and types of oil filters. It gives methods for gravity purification of lubricating oils and also methods for claiming or refining used lubricating oils.

Learning to Weld 32 *pp,* 5½x8½ *in.,* 83 *illust, including photos and drawings, paper cover,* 25¢, *postpaid in U. S., elsewhere* 35¢. *Lincoln Electric Co, Cleveland* 1, *Ohio.* Booklet teaches how to weld and apply arc-welding to repair of broken parts, hard surfacing of worn parts and building miscellaneous equipment. Subjects treated include: protective clothing and equipment; striking the arc; various welding positions; types of welds; fit-up of parts; procedures for various welds; welding cast iron; hard surfacing. Included are conversion tables on decimal equivalents and thicknesses of metal in gage and inches.

Cadman Memorial Medal for outstanding research in petroleum science has been awarded to Robert P Russell, president of Standard Oil Development Co. Cadman medal is awarded at least once every three years for scientific contributions in field of petroleum. Mr Russell will receive the medal June 4 when he delivers the second Cadman memorial lecture in lecture hall of Royal Institution, London. He will speak on *Progress in Petroleum Research.*

Dr Charles A Thomas, vice-president and technical director of Monsanto Chemical Co and one of the key figures in development of atomic energy, has been awarded the 1947 Industrial Research Institute Medal, presented for outstanding contributions to field of industrial research. The medal will be presented June 5 during annual meeting of the Institute at Swampscott, Mass.

Federal Power Commission has issued a certificate of public convenience and necessity to Natural Gas Pipeline Co of America and Texoma Natural Gas Co, authorizing construction of additions to their gas transmission facilities operated as an integrated natural-gas transmission system extending from Panhandle Field in Texas and supplying market areas in Ind., Iowa, Kan., Neb., Wis. and Ill. Aggregate cost of facilities is estimated at $23,493,987. Installation is expected to be completed about Jan 1, 1949.

Refrigeration Equipment Manufacturers Association announced a permanent, far-reaching policy of national refrigeration expositions, centering around the holding of one all-industry show every two years beginning in Jan 1948. The program was voted unanimously by directors of the association following an analysis of results of the Fourth All-Industry Refrigeration and Air Conditioning Exposition in Cleveland last fall.

This coolant may be distilled and relatively chemically inert fresh water, as in the case of air ejector inter- and after-coolers in certain Marine and stationary power plants, or relatively clean sea water containing chlorides and sulfates of sodium, potassium, magnesium and calcium with minor quantities of other salts, in a condenser aboard a ship under way. It may be brackish water containing not only the chemicals found in natural fresh and sea waters, but often the more chemically active waste products of industrial plants; or, in an oil refinery heat exchanger, it may be crude oil absorbing the heat of vaporization of one or more of the fractionated constituents.

Whatever the chemical composition of this medium may be, it is not the sole determinant of tube life in an actual installation, but must be considered in combination with some or all of such other factors as:

Velocity and turbulence of coolant . . . Abrasives suspended in coolant . . . Dissolved or entrained air or gases . . . Temperatures inside and outside of tubes . . . Marine growths or other deposits . . . Development of protective film . . . Media surrounding tubes.

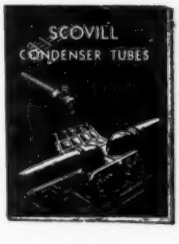
One of the principal objects of Condenser Tube Technical Research has been the development of alloys designed to give longest life and most trouble-free service. Today's copper-base condenser tube materials, with an occasional resort to an alloy not usually considered in this connection, cover a wide range of uses, not only in the Marine and stationary power industries, but in the chemical and petro-chemical fields as well.

The conditions surrounding any given Condenser Tube installation are many and varied, so that each installation must be treated as an individual problem.

Scovill has made, or is making, extensive studies of Condenser Tube service conditions for every known application, and offers the facilities of its Technical Service Department in the selection of suitable Condenser Tube alloys to meet specific service conditions in an existing or proposed installation.

THREE SCOVILL SERVICES

Scovill's *Service in Men* offers experienced engineering to help solve your tube selection and installation problems. *Service in Metals* develops and produces Scovill tube alloys that conform to your requirements. *Service in Manuals* consists of literature which gives you latest, authentic information on condenser and heat exchanger tubes. A Condenser Tube Booklet is available. Scovill Manufacturing Co., 13 Mill St., Waterbury 91, Conn. *Export Department:* 405 Lexington Ave., New York 17, N. Y.



SCOVILL

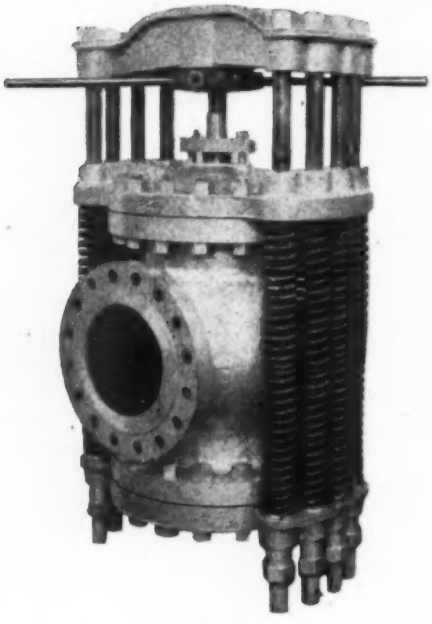
SCOVILL

CONDENSER TUBES

One Product • Three Services

Service in Manuals • Service in Metals • Service in Men

A VALVE THAT WILL INTEREST EVERY POWER ENGINEER



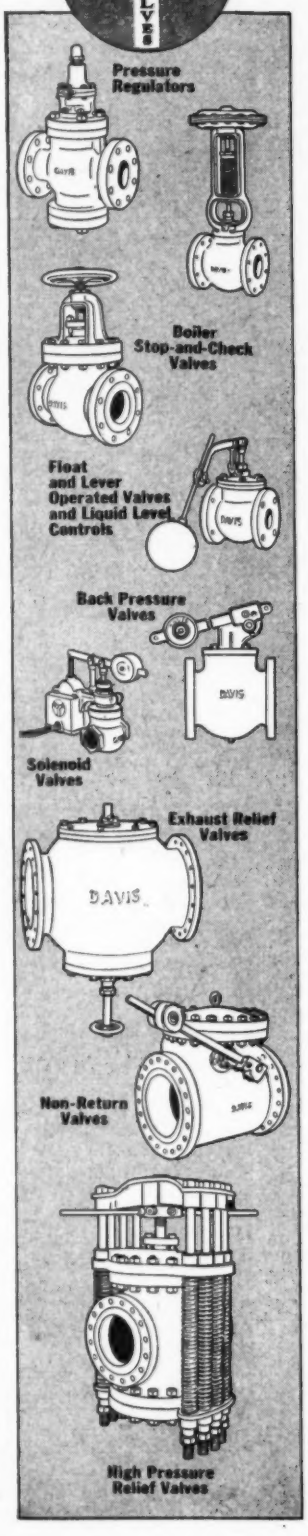
The DAVIS No. 265 HIGH PRESSURE RELIEF VALVE

USES. — (1) For turbine relief on bleeder system. (2) For protection of any boiler room or process equipment by relief to atmosphere. (3) For relief of high pressure lines to low pressure lines at predetermined pressure. (4) For use in plants carrying multiple boiler pressures to protect lower pressure systems.

ADVANTAGES. — Multiple springs result in less spring accumulation . . . less build-up for maximum relief . . . less blowdown to close. Compact design with springs at sides reduces headroom requirements. Center adjusting screw available for quick, easy change of pressure setting.

BUILT TO MEET YOUR REQUIREMENTS. Offered in sizes from 4" to 30" in semi-steel or steel with bronze or stainless steel trim. Test lever and hold-open device available when desired. Detailed information on request.

DAVIS VALVES



DAVIS REGULATOR CO.

Representatives in All Principal Cities

2540 S. WASHTENAW AVE., CHICAGO 8, ILL.

APPOINTMENTS

American Locomotive Co announces appointment of Holmes Brown as director of public relations and advertising. R Tom Sawyer has been made manager of research dept.

Alfred J Yardley has been elected president of **Jenkins Bros,** succeeding his father, Farnham Yardley, who became chairman of the board. James L Dunn, vice-president in charge of industrial relations, and C C Chamberlain, general sales manager, were elected to board of directors.

General Controls Co names E B Maire regional sales manager of Midwestern, Southern and Eastern branch office territories: Boston, New York, Philadelphia, Pittsburgh, Detroit, Cleveland, Atlanta and Chicago. He will assist and coordinate efforts of these factory branch offices with the factory.

Hans Gartmann has been made chief engineer of centrifugal pump and compressor dept of **De Laval Steam Turbine Co.** Harry Engvall has been appointed chief engineer of helical gear dept. Harold V Rasmussen became chief engineer of turbine dept.

Ladish Co announces establishment of a new district office in Atlanta, Ga., and discontinuation of its New Orleans office. The new office will be at 452 Spring St, N W, and will serve the Southeastern territory. W. W. Bowie, formerly manager of New Orleans office, has been appointed manager of Atlanta office.

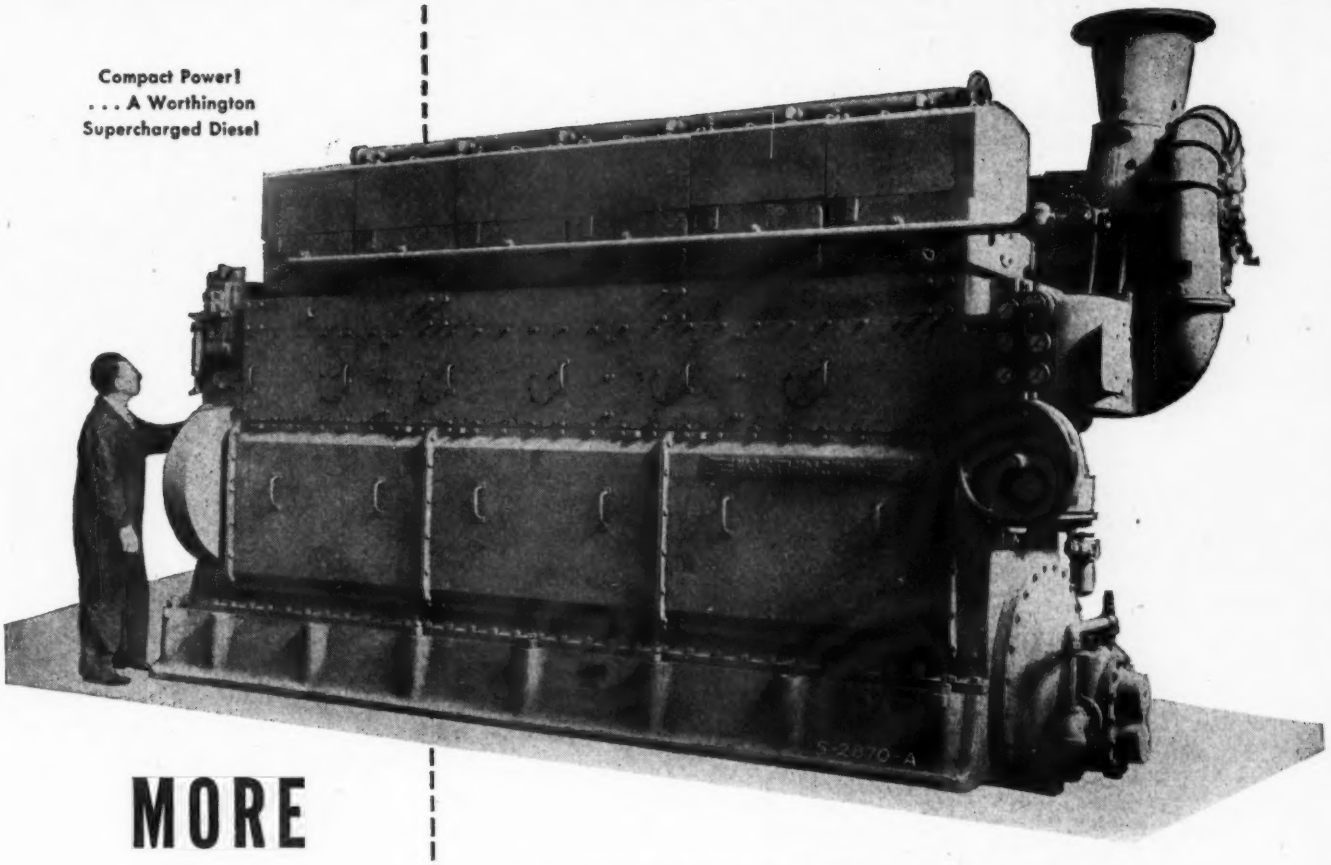
Joseph C Edler has been named sales engineer with superior engine div of **National Supply Co,** with headquarters in Chicago. Edler will represent the company in its marine business on Great Lakes, and industrial and stationary installations in lake-bordering counties of Wis. and Ill., lower peninsula of Mich., parts of Pa., N. Y. and Ohio. E D Cahill will continue to handle river marine trade in the territory.

Square D Co has appointed G H LaPiner advertising manager of switch and panel div in Detroit, with D A Roehm as assistant to advertising manager. In industrial controller div, Milwaukee, advertising section of sales dept will be headed by T C Vogel. T B Martin has been made production manager of industrial controller div.

Minneapolis-Honeywell Regulator Co and its industrial div, Brown Instrument Co, Philadelphia, have opened a district office at 27 Halstead St, E Orange, N. J.

Plans have been disclosed to expand manufacturing facilities at **Westinghouse Electric Corp's** Buffalo, N. Y., plant. The new operation, formerly a part of switchgear and control div at E Pittsburgh, will be known as industrial control div. To facilitate the transfer, L R Ludwig, manager of motor div, has been assigned responsibility for this operation in its present location. Operations at Buffalo will eventually in-

Compact Power!
. . . A Worthington
Supercharged Diesel



MORE

KILOWATT HOURS

PER GALLON

OF FUEL OIL

LESS

INSTALLATION

MAINTENANCE

AND LUBRICATION

COSTS

. . . with Worthington 4-cycle Supercharged Diesels

In a tropical climate, furnishing electricity for motor-driven refrigeration compressors is one of the toughest engine-jobs going — calling for completely dependable, uninterrupted output. That's why the following record of a Typical Worthington Diesel installation for a big Central-American refrigeration plant is of vital interest to every power user. At the end of 34 months of continuous operation, three Worthington SDD-6 Diesels (500 kw. supercharged) produced these results:

Hours of operation, combined	43,764
Average kilowatt hours per year, combined	4,993,633
Running-engine-capacity factor	64.7%
Average kilowatt hours per gallon of fuel oil	14.08
Total Annual maintenance cost per engine H.P.	33.8 cents

Here's 10% to 15% more kilowatt hours per gallon of fuel oil, with minimum upkeep and replacement costs! Then there's 25% lower lubricating oil consumption . . . big reductions in building space, foundation materials and installation labor . . . adding up to tops in Diesel efficiency, with savings all along the line!

Today, Worthington installations of like capacity supply entire communities with electricity, while all over the world Worthington Diesels meet industry's needs for continuous, trouble-free, economical power.

Write for details . . . and further proof that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Engine Division, Buffalo, N. Y.*

WORTHINGTON

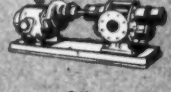
E7-2

YOUR PARTNER IN POWER PROGRESS

Diesel engines, 150 to 3,290 hp . . . gas engines, 175 to 3,500 hp . . . dual fuel engines, 150 to 3,290 hp.

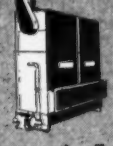
WORTHINGTON-BUILT AUXILIARIES

Air King Compressors



Oil Transfer Pumps

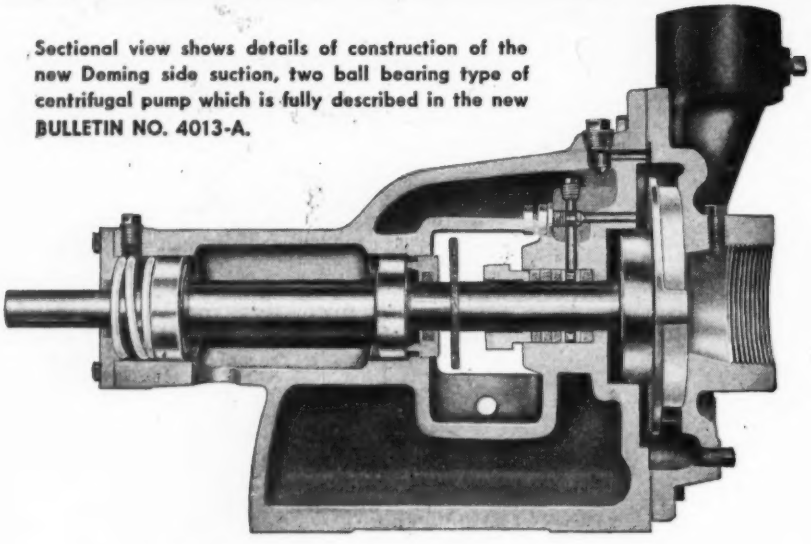
Cooling Water Circulating Pumps



Evaporative Type Engine Water Cooler

PUMP NOTES by DEMING

Sectional view shows details of construction of the new Deming side suction, two ball bearing type of centrifugal pump which is fully described in the new BULLETIN NO. 4013-A.

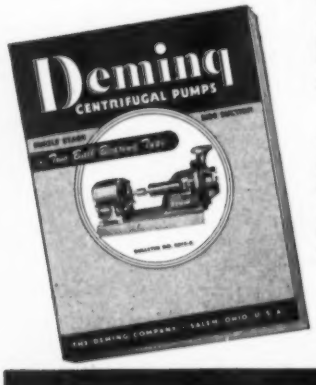


NEW Side Suction Centrifugal Pumps

The two ball bearing design and sturdy construction of these new Deming Centrifugal Pumps recommend them for conditions demanding long periods of operation with a minimum of maintenance attention. The position of the two ball bearings in the barrel shaped portion of the support head removes the bearings from any contact with the liquid being pumped. (See illustration.) Ample space is provided for easy access to the stuffing box packing.

The semi-enclosed impeller is the three vane, non-clogging type. Every impeller is statically and dynamically balanced. Impeller clearance may be adjusted while the pump is operating.

The complete line of these new pumps includes Figures 4003, 4013, 4023, and 4033. Sizes range from 1 to 6 inch discharge with capacities from 10 to 1200 gallons per minute. Pumps can be furnished for belt drive, electric motor, or gasoline engine drive.



SEND FOR BULLETIN NO. 4013-A

This 16-page, illustrated bulletin fully explains all details of design, construction, and operation. Performance tables for all motor driven and belt driven pumps simplify selection to meet specific requirements. A copy of the new bulletin will be forwarded to you immediately upon request.

THE DEMING COMPANY
203 BROADWAY • SALEM, OHIO

DEMING
INDUSTRIAL PUMPS

clude motor, industrial control, copper wire and welding activities, and will be known as Buffalo divisions, rather than Buffalo motor div. Ludwig will be manager of Buffalo divisions.

Westinghouse Electric Corp announces appointment of John E Payne as headquarters industrial sales manager. C B Stainback has been named industrial syndicate manager, a new position created for better coordination of industrial sales activities of the company. Robert A Neal has been made general manager of company's expanding Pacific Coast operations.

H J Fraser and H J French were elected as additional vice-presidents of **International Nickel Co.**

Bailey Meter Co has added two marine service men to its staff of field engineers: (1) J R Sullivan has joined the N. Y. branch office, 30 Church St. (2) M J Bonnette is joining Houston branch at 6539 Brompton Rd.

J A Bynum has been appointed special representative by **American Chain & Cable Co** on Reading-Pratt & Cady valves for petroleum industry in Southwest. J J Reed has been made Southwest district sales manager, succeeding Bynum. Both men will make their headquarters at 630 McFarland St, Houston.

Harold P, William W and Delbert P Hesler, professional engineers, formed the **Hesler Co.** Their office at 950 Dierks Bldg, Kansas City 6, Mo., has been commissioned by Electric Machinery Mfg Co, Minneapolis, Minn., to sell their line.

E W Heffernan has been appointed manager of new Philadelphia sales and service office of **Wheelco Instruments Co** at 424 W Olney Ave, Philadelphia.

Wheelco Instruments Co has consummated an arrangement whereby Wheelco instruments will be manufactured and marketed throughout the United Kingdom by Ether, Ltd, of Birmingham, an English instrument manufacturer. The instruments will be sold under name of Ether-Wheelco controls.

Industrial div of **York-Shipley, Inc,** announces an expanded sales and service organization: (1) F W Cooper is assistant manager of industrial div. (2) J Walz Jr is district manager for Middle West. (3) R P Lindemuth is district manager for Middle Atlantic. (4) C M Keady is Southern district manager. (5) W S Tallon is application engineer for this div. (6) E W Hagblom and B S Shewell are field service engineers. York-Shipley industrial div has also expanded its distributor organization.

New full-line dealers of **Davey Compressor Co** are: (1) Barton-Stephens & Co, 822 S W 9th St, Des Moines, Iowa. (2) Equipment Rental & Sales Corp, 1211 S 5th St, Minneapolis, Minn. (3) Highway Equipment & Supply Co, 21st & N St, Lincoln, Neb. (4) Industrial Equipment Co, 10911 Russett St, Oakland, Calif. (5)

Headquarters for the

MOST COMPLETE LINE

of DROP FORGED STEEL VALVES, FITTINGS & FLANGES

WRITE!

WIRE!

PHONE!

Air View of Henry Vogt Machine Co. Plant, Louisville, Ky.

VOGT provides one convenient, economical source of supply with the most comprehensive line of drop forged steel piping materials anywhere available to industry. Here will be found everything needed for the safe and efficient control of oil, steam, water, air, gas, and ammonia at high or low pressures and temperatures.

More drop forged steel Valves, Fittings and Flanges are made by Vogt, and deservedly so, because Vogt makes them better!

HENRY VOGT MACHINE CO.
INCORPORATED
Louisville 10, Ky.

Branch Offices: NEW YORK • PHILADELPHIA
CLEVELAND • CHICAGO • DALLAS

Send for copy of Catalog F-8

Vogt

DROP FORGED STEEL VALVES, FITTINGS AND FLANGES

GUARANTEED

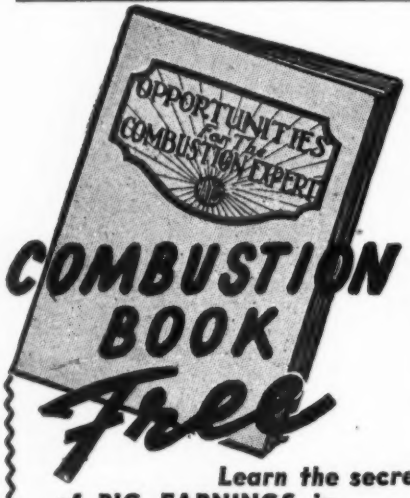
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degree temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service. Insure carefree maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.



Learn the secret
of BIG EARNINGS in . . .
COMBUSTION ENGINEERING

There are plenty of good pay jobs in the power field today. Increase your earnings now—be a Hays-Trained Combustion Engineer. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

Approved for GI. Write for Free Book Now!

Hays Institute of Combustion
430 N. Michigan Ave., Chicago 11, Ill.
(Dept. 15) Our 28th consecutive year

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430 N. Michigan Ave., Chicago 11, Ill.
(Dept. 15) Please send free book.
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City ..... State .....
Company Name .....

Mertes Machinery Co, 1622 S 1st St, Milwaukee, Wis. In addition, industrial compressor distributorships have been awarded to R V Seaman Co, 822 Janes Ave, Saginaw, Mich.; and Seaman-Detroit Corp, 7361 Fenkell Ave, Detroit, Mich. Floyd Jones has been appointed sales manager of portable compressor div.

Clark M Wright has been appointed assistant manager of turbine div, **General Electric Co,** Schenectady. R C Sogge has been made manager of general station divisions. Lee F Adams has been named standards consultant of standards div. Robert A Nisbet has been named superintendent of Waterford works of chemical dept. Waterford, N. Y., works is now under construction and will be used for manufacture of silicone products. Robert W Ferrell has been made manager of employe and community relations of affiliated manufacturing companies dept. L R Boulware is general manager of the dept, representing seven affiliated companies of GE.

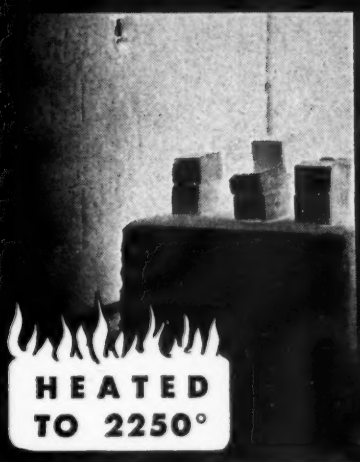
General Electric Co named H A Cook and Bert Robertson Jr district representatives for construction materials sales in Philadelphia area. Cook will handle wire sales and Robertson accessory equipment products. W C Clough has been appointed district representative to handle wire and cable, conduit products, wiring devices and accessory equipment in Denver area. H A Rawson, W M Snyder and J V Onkey have been made representatives in Chicago. Rawson and Snyder will represent accessory equipment div. Onkey will handle rectifiers. D L Savacool and F E Brown have been named construction materials representatives in Boston area. Savacool will handle wire products and Brown will handle accessory equipment.

Appointment of three new **General Electric** construction materials representatives in New York City area has been announced. Earl Wilson will represent tungar and metallic rectifier div. W H Jones and C J Michaud Jr will represent accessory equipment div. D F Flinn and W P Barrett have been named to handle accessory equipment and conduit products respectively in Cleveland area. D F Torrey Jr has been made construction materials sales representative for accessory equipment in Cleveland area.

A new local office has been established by **General Electric Co's** construction materials divisions at 615 Fox Bldg, Detroit. New office will be staffed by E O Callander, S C DeVos, R D Link, G D Shaffer, D F Torrey and Walter Pfaltzgraff. Ray Wienecke has been appointed representative for accessory equipment in Kansas City, Mo., area. G J Brenner has been made representative of tungar and metallic rectifier div in Northwest. George W Scully has been named wire and cable representative in Atlantic district.

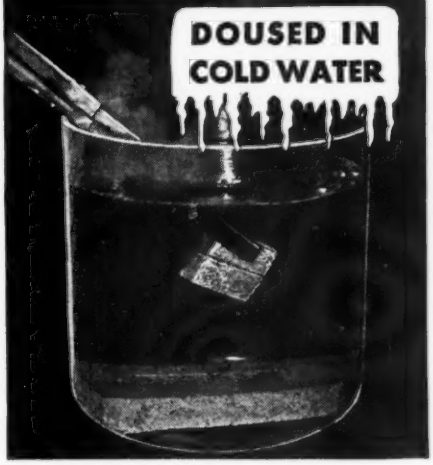
Perfex Corp announces that V Robins Tate was elected executive vice-president. Hugh Kelly has been named chief engineer. Kelly will be responsible for design, research and test of all controls div products, as well as production engineering of

Demonstrating
BRICKSEAL
REFRACTORY COATING



Brickseal provides a crackproof, vitrified armor for furnace linings. The small firebricks shown in the furnace were bonded and painted with Brickseal and heated to 2250°. Directly from the furnace they were plunged into cold water as shown below—a test for *any* material subject to expansion and contraction.

Brickseal is *semi-plastic when hot,* yet *hard and tough when cold.* Brickseal is made in grades suitable to heats ranging from 1400° to more than 3000°. It will make any furnace last longer by giving new life to your refractories. Write or call local dealer for a demonstration.



BRICKSEAL
REFRACTORY COMPANY
5800 S. Hoover St., Los Angeles, Cal.
1029 Clinton St., Hoboken, N. J.

It's Easy TO CHANGE TO DARCOVA

THE ORIGINAL COMPOSITION CUP

MOST engineers and operators in charge of reciprocating pumps are aware that Darcova Pumcups offer distinct advantages over piston packing of other types—that Pumcups last 5, 10, or even 100 times as long, that fluid slippage is all but eliminated, that efficiency doesn't decrease with Pumcup wear, that pump speed can be reduced and volume increased, that power is saved, and that downtime and maintenance expense are cut to a fraction.

But what many of these men are not aware of is the downright simplicity of changing over to Darcova Pumcups. It's easier than replacing with the old type packing.

To simplify the change-over, to prolong liner and pump life, Darling Pistons are recommended. They are carried in stock at all times, can be supplied in various metals and alloys for every industrial need.

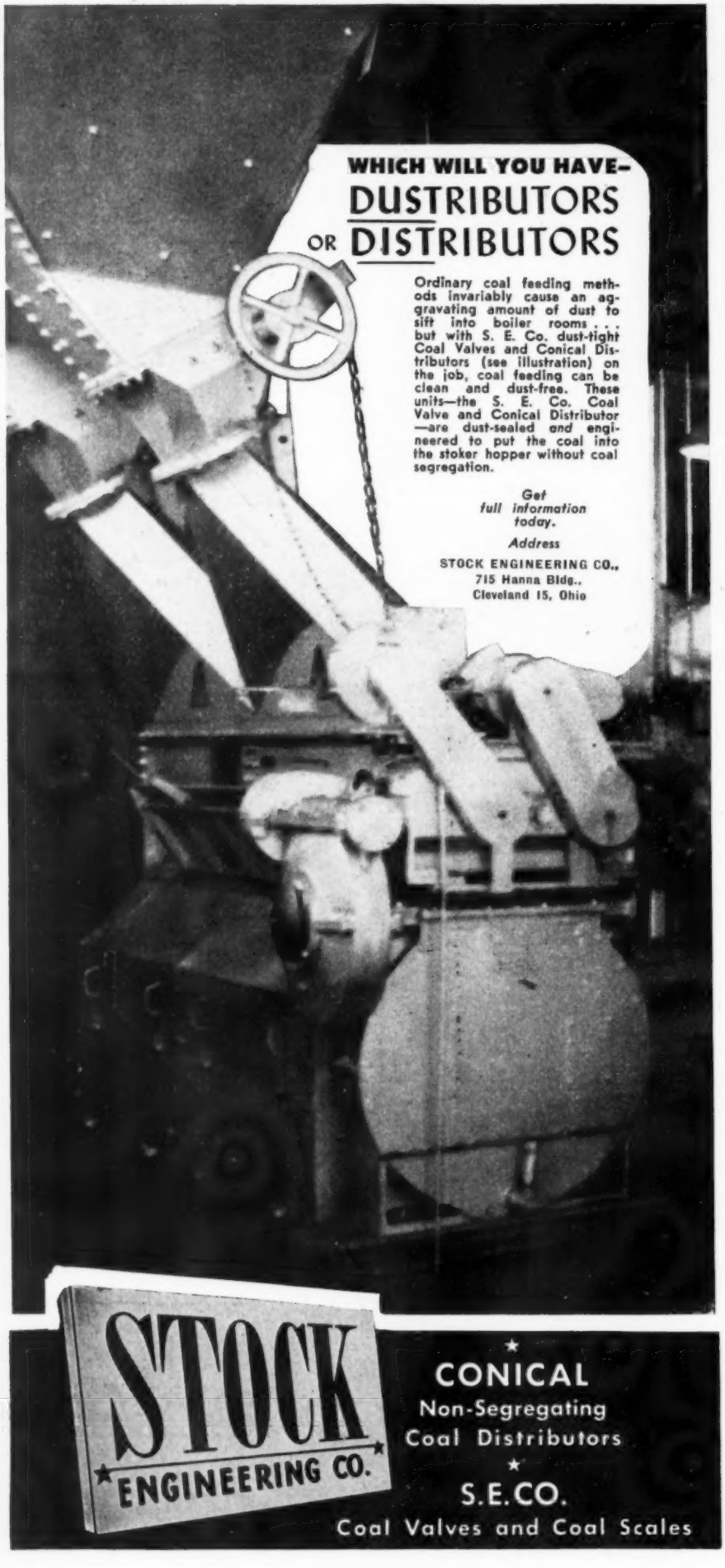
For a free bulletin containing complete information, write, or use the coupon below.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 61, Pa.
Please send me the free bulletin checked below:
☐ No. 4401 Darcova Pumcups for reciprocating pumps.
☐ No. 4502 Darcova Pumcups for air or hydraulic mechanisms.

Name_____
Company_____
Address_____
City_____ State_____


WHICH WILL YOU HAVE–
DUSTRIBUTORS
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Ordinary coal feeding methods invariably cause an aggravating amount of dust to sift into boiler rooms . . . but with S. E. Co. dust-tight Coal Valves and Conical Distributors (see illustration) on the job, coal feeding can be clean and dust-free. These units—the S. E. Co. Coal Valve and Conical Distributor—are dust-sealed and engineered to put the coal into the stoker hopper without coal segregation.
Get full information today.
Address
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STOCK
ENGINEERING CO.
CONICAL
Non-Segregating
Coal Distributors
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Coal Valves and Coal Scales

all company products. Chris J Jensen Sr has been appointed foreign representative and engineer. He will make his headquarters in Oslo, Norway, working with European manufacturing accounts and Perfex exporting agent in educational programs.

L C Joralemon, for many years a field representative for Weston Electrical Instrument Corp, Newark, N. J., has formed firm of **Joralemon, Craig & Co,** 112 S 16th St, Philadelphia 2, to carry on the business. Joralemon's partner in the enterprise is D K Craig, who has long been associated with him. New company will handle sales of Weston instruments in southern N. J., eastern Pa., District of Columbia, Fairfax County in Va., and Md., with exception of Allegheny and Garrett Counties. In addition to representing Weston Corp, Joralemon, Craig & Co will also continue to act as field representative for American Transformer Co, Newark, N. J., Western Electro Mechanical Co. Oakland, Calif., and Radio Frequency Laboratories, Inc, Boonton, N. J.

Liquid Conditioning Corp has removed its main office and plant to 114 E Price St, Linden, N. J., to take care of its expanding business. L S Luther & Co, 1018 18th St, N W, Washington 6, D. C., has been appointed engineering sales and service representatives in District of Columbia, most of Va. and most of Md. The organization also includes W Norman Meyer, mechanical engineer.

Hewitt rubber div of **Hewitt-Robins Inc** has appointed Ellis & Lowe Co as a new distributor for Hewitt's industrial rubber products in Tampa, Fla., area.

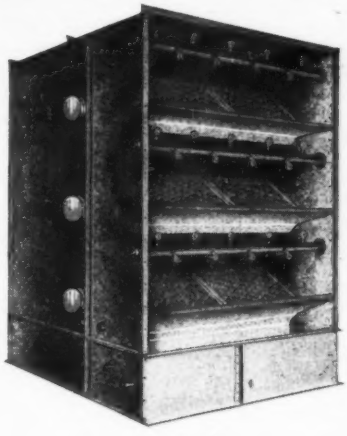
Monsanto Chemical Co elected Frederick M Eaton to board of directors. Frederic L Matthews has been appointed associate director of research of Merrimac div at Everett, Mass. Harry W Faust became coordinator of petroleum additives in organic chemicals div. J F Palmer has been named a group leader in petroleum chemical research in organic chemicals div. Walter A Vahle has been appointed assistant to director of purchases and traffic of Monsanto for assignment to special duties. Harry F Klocker has been made general traffic manager to succeed Vahle.

Advancement of E Labadie of process engineering dept to service manager has been announced by **Progressive Welder Co.**

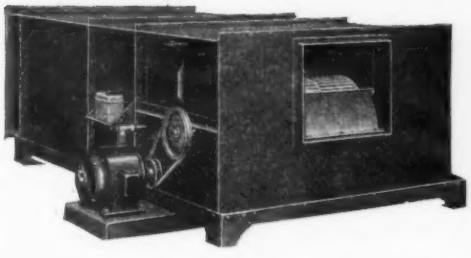
Brig Gen James Creel Marshall has been retained on engineering staff of **M W Kellogg Co.**

A N Mason has been named eastern N. Y. representative of **Eclipse Fuel Engrg Co.** He will be at 53 Park Pl, New York City.

H K Clark was elected president of **Carborundum Co,** succeeding Arthur Batts, who has been elected chairman of the board. Edwin R Broden was made vice-president in charge of operations, member of board of directors and member of executive committee of which President Clark be-



AIR WASHERS
AND PURIFIERS



MULTITHERM
CONDITIONING UNITS

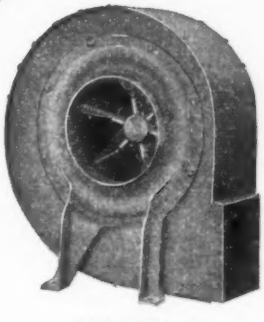
VENTILATING AND
CONDITIONING FANS

Clarage

—HEADQUARTERS FOR AIR HANDLING AND CONDITIONING EQUIPMENT

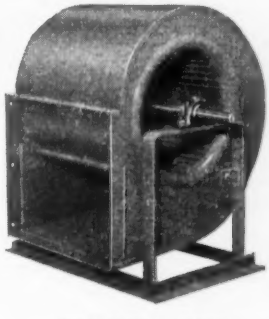
FOR nearly 40 years — *through constant product improvement* — Clarage has maintained leadership in this specialized field . . . Directing your air handling and conditioning requirements our way is to place them in capable hands . . .

CLARAGE FAN COMPANY
Kalamazoo, Michigan
Application Engineering Offices in all Principal Cities



INDUSTRIAL
PROCESS FANS

UNICOIL
CONDITIONING UNITS



FURNACE AND
UNIT CONDITIONER FANS

DART

is a better name for Union

• These two bronze seats in each Dart Union are spherical-ground to insure a drop-tight, leak-proof connection without excessive wrenching. What's more, Darts open as easily as they close, making it possible to use the same union over and over again in different locations. Body and nut are made of high-test, air-refined malleable iron and are practically indestructible. That's why it's wise to say *Dart* when you think of *Unions*.

Your supplier will be glad to show you the many advantages of Darts.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

comes chairman. William Hall Wendel was named administrative assistant to Clark. Otis Hutchins retired as technical director. He will be succeeded by Harry C Martin. Donald G Foot assumes newly created title of administrative assistant to technical director. Edward R Newcomb has been made director of sales engineering of coated abrasive div throughout the U. S. Boyd H Work has been named director of sales engineering in U. S. and Canada for bonded abrasive div.

Carborundum Co has promoted S S Diemer to office of manager of purchases and Richard Kimball to assistant manager of purchasing. William E Blake assumes title of purchasing agent. In technical div, George J Easter assumes added duties and responsibilities, having been appointed manager of research and development, with Charles Wooddell and Garret VanNimwegen as assistant managers. Henry R Power has been promoted to manager of laboratories, with F P Ronca and Walter G Lautz as assistant managers. Fred A Upper has been advanced to post of manager of manufacturing technical service. Reporting to Upper will be Arthur H Prey, who has been appointed assistant manager of manufacturing technical service. Prey is to have functional control over several plant technical service divisions.

W T Stratton is appointed director of purchases of **Wickwire Spencer Steel Div** of Colorado Fuel & Iron Corp. He will be at 361 Delaware Ave, Buffalo 2, N. Y. Stratton will replace E A Johnston, who has resigned.

Fairbanks, Morse & Co named John A Cuneo manager of Los Angeles branch, succeeding Harry W Brown who has retired.

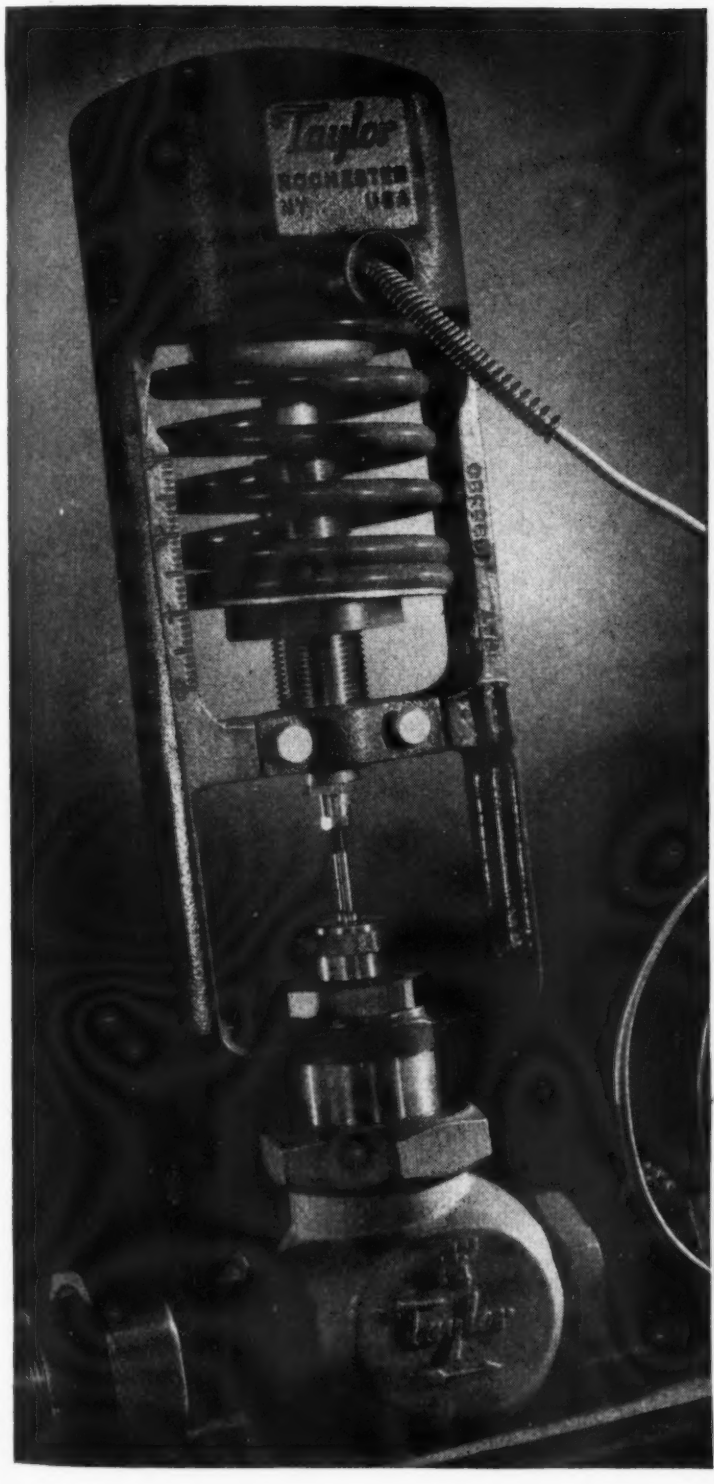
William P Webster has been elected to board of directors of **Clark Mfg Co.**

Ken O Hood is new Pacific Coast district manager for **Falk Corp.** With headquarters in Los Angeles, he will direct Falk sales in Calif., Wash., Ore., Nev., N. M., Ariz., Colo., Utah, Idaho and parts of Wyo. Kenneth W Morrissey returns to Cincinnati as district manager after an absence of four years, which he spent at the home office on special assignment during the war.

American Brake Shoe Co announces opening of a new sales office at 1500 Walnut St, Philadelphia, which will be occupied jointly by representatives of four divisions: James J Nelson will represent national bearing div; Thomas N Mitchell, district manager, the Kellogg div; L John Harwood, the electro-alloys div; and George E Anne, the brake shoe and castings div. National bearing div names Emmett A Williams vice-president in charge of operations and I E Cox vice-president in charge of engineering.

Laclede-Christy Clay Products Co elected Donald N Watkins president and general manager, succeeding William P Hemphill. Walter W Shipley was elected a vice-president. Following officers were re-elected: W F Godejohn, vice-president;

YOU NEED 'EM AND WE HAVE 'EM



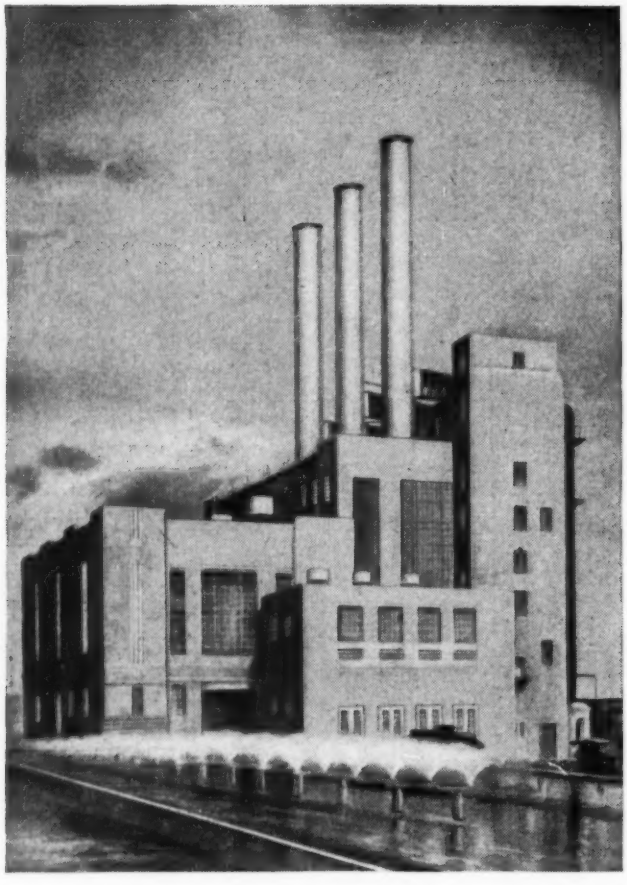
SOMETIMES our customers ask for a Taylor Fulscope Air-Operated Controller for applications where a simple, dependable Taylor Self-Acting Controller would do the job.

Typical jobs which the Taylor Self-Acting Controllers take in stride are: hot water tanks, diesel water jackets, feed water systems, wax coating machines, plating and rinsing tanks, bottle and can washers, mixing and cooling kettles, crude oil treaters, condenser cooler water in stills, oil field superheaters, etc.

They require no auxiliary air supply for operation. Double seated valves are available in sizes up to 2″; single-seated composition disc types up to 1″. Numerous standard temperature ranges within limits of 10° and 340° F, and semi-standard ranges within limits of 165° and 610° F.

Immediate delivery now available! Write for catalog 36-R. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY



How modern is your POWER PLANT?

Many industrialists have been so concerned with keeping abreast of manufacturing technique that their power generating plants and equipment have become relatively obsolete. Both power costs and plant reliability should be kept as fully up-to-the-minute as process technique if full economy is to be obtained.

Kuljian Engineers have specialized for years in power plant design, construction and operation. It will pay you to call on us for assistance in the modernization of your power plant. Your inquiry is invited now.

THE KULJIAN CORPORATION

Engineers • Constructors

1518 Walnut Street • Philadelphia 2, Pa.

New York 6 Washington 5

L C Hewitt, vice-president; J L Cummings, vice-president; R T Risk, secretary and treasurer; J H Schoemaker, assistant secretary. Following directors were re-elected to serve for ensuing year: J LeBeau Christy, W F Godejohn, W P Hemphill, W W Shipley, W D Thompson, D N Watkins, J G Williams.

Appointment of a regional manager and five dealers was announced by **Hydro-Power, Inc:** Joseph C Tourne, General Engrg & Equipment Corp, 618 Carondelet Bldg, New Orleans, has been made regional manager for southern section of U. S. American Machinery Corp, Orlando, will handle Hydro-Power equipment in Fla.; Jack Fanning, Atlanta, in Ga.; Riddell Engrg Co, Birmingham, in state of Ala.; Southern Engrg & Supply Co, Vicksburg, in Miss.; and D B A Engrg Sales Co, Houston, in Texas.

Elgin Softener Corp announces that Fred S Crook has been appointed district engineer of St. Louis territory, which includes eastern Mo., southern Ill. and western Ky.

Leavitt Machine Co announces two recent appointments: Samuel J Reid was elected vice-president and clerk, and will be in charge of sales. A N Willett was elected vice-president, assistant treasurer, and will be in charge of production.

Melville F Peters has been appointed chief engineer of **Titeflex, Inc.** Gordon J Wygant became assistant sales manager.

Rockwell Mfg Co elected W F Rockwell Jr president. Willard F Rockwell will retain office of chairman of board. All other officers were re-elected.

Appointment of B E McNeil as Houston representative, at 1101 Chenevert St, has been announced by **Helwig Co.**

Bell & Gossett Co has named Frank C Hackett sales promotion manager.

Henry G Mahoney will manage purchasing for lighting fixture div of **Sylvania Electric Products Inc.**

Michael P Walker has been named general sales manager of Alsoco Corp. He is responsible for sales, advertising and general promotion of Alsoco, a newly developed aluminum solder.

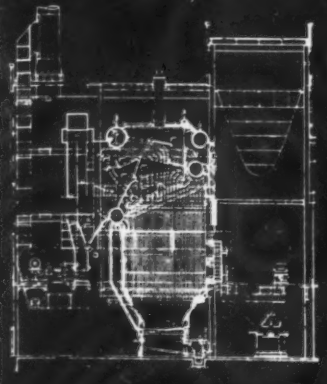
Ohio Edison Co promoted Malcolm W Smith to newly created position of superintendent of production and transmission construction. Alfred L Richmond, superintendent of electrical operations, will take on additional duties of maintenance of all electrical equipment installed in operating stations and substations.

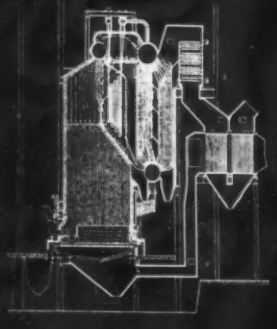
J Frank Ward has been appointed superintendent of **Tacoma City Light.**

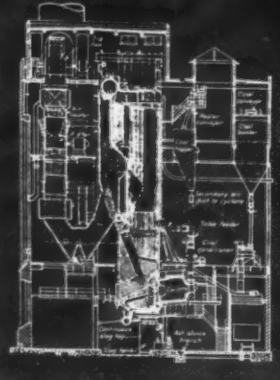
Board of directors of **Cleveland Electric Illuminating Co** re-elected following officers: Elmer L Lindseth, president; Dean C Ober, executive vice-president; Sydney

Spend an EQUIPMENT DIME To save a FUEL DOLLAR

First Cost Means *LITTLE...*
Second Cost (Fuel) Means *EVERYTHING*







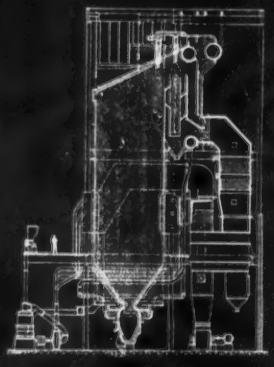
A modern boiler installation will burn its original cost in fuel each year of its life. ***So...fuel cost is the thing!***

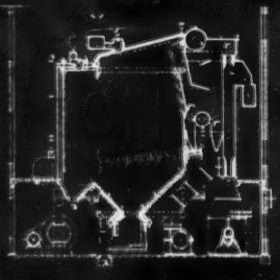
An additional investment of 10 per cent... or less...will give a modern boiler unit full fuel-burning flexibility. These **"plus dollars"** give an incomparable high rate of return . . . often more than 100%. *(Compare this with bonds paying 3%).*

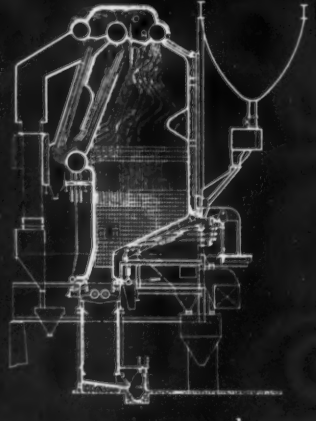
"*Flex*-Ability" to use the most economical steam coals on the market quickly amortizes the additional investment . . . usually during the first year of operation.

Thereafter, for its life span of 25 to 30 years of trouble-free operation, a flexible boiler unit will be a great dividend earner.

IT IS ECONOMICAL TO DESIGN FOR WIDE FUEL FLEXIBILITY







Fairmont Coal Bureau serves industry through engineering bulletins and collaboration with equipment manufacturers, consulting engineers, and consumers. It has helped thousands of industrial fuel users since 1942.

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FAIRMONT COAL BUREAU, Chanin Bldg., 122 E. 42nd St., New York 17, N. Y.

Write for Reference Bulletins Nos. 1 to 9 inclusive (if you do not already have them) that cover fuel economics affecting design of modern boiler units. Your request will automatically put your name on the Coal Bureau's mailing list.

P-5-47

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Whenever you are confronted with a particularly difficult maintenance cleaning problem . . . or whenever you would like to know whether or not you can reduce your present cleaning costs, put your problem up to us. Call in Oakite Technical Service. Let an Oakite Representative, study your conditions at first hand, and, on the basis of his findings, recommend the cleaning and sanitation practices that will best meet your needs.

Oakite welcomes the opportunity to place at your disposal all their technical service facilities, including:

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Technical Representatives in Principal Cities of U. S. & Canada

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Specialized Industrial Cleaning
MATERIALS • METHODS • SERVICE

L Hall, vice-president and secretary; Paul V Dopler, treasurer; Ralph H Smith, controller; Louis F Scholley, assistant controller; Harry D Ballard, assistant treasurer; and Ralph H Holcomb, assistant secretary.

Wallace H Henshaw has been elected vice-president of **Hartford Steam Boiler Inspection & Insurance Co.**

E B Bynum, vice-president of Memphis Light, Gas & Water Div, was named vice-president of **Public Power Association** at a convention in Chattanooga. States Finley, general superintendent of Chattanooga Electric Power Board, was elected president. Other officers: (1) W W Jacobs, Cleveland, Tenn., vice-president (2) J F Perry, Clarksville, Tenn., vice-president (3) L E Price, Tupelo, Miss., vice-president (4) W H Sacton, Batesville, Miss., secretary-treasurer.

Hays Corp promoted Shirl M Rudolph to vice-president in charge of sales and William H Pugsley to vice-president in charge of field research. Rudolph has served since 1920 in accounting dept, as factory manager, as assistant to president and in various sales capacities. Pugsley joined Hays in 1932 as manager of combustion control div after sales and office experience in Cleveland and Chicago offices.

Propeller Fan Manufacturers' Association elected following officers for ensuing year: W J Lohman Jr, president; M L Aitken, vice-president; and L O Monroe, secretary-treasurer. Lohman is treasurer of Chelsea Products, Inc, Irvington, N. J., and Aitken is general manager of Propellair, Inc, Springfield, Ohio.

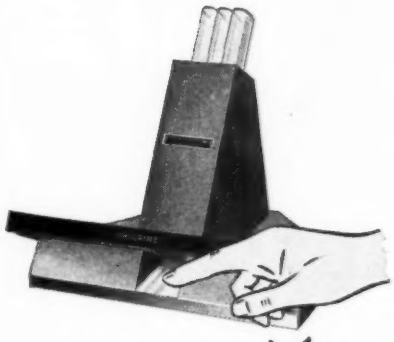
John D Coleman was elected president of **Ohio Society of Professional Engineers.** Coleman, a chemical engineer with Frigidaire div, General Motors Corp, succeeds Allison C Neff. Other officers named were John Heier and Arthur E Rowe, vice-presidents; J R Shank, treasurer; and D W Converse, secretary.

National Association of Fan Manufacturers elected following officers for ensuing year: T J Flanagan, president; G C Derry, vice-president; and L O Monroe, secretary-treasurer. Flanagan is president of Garden City Fan Co, Chicago, and Derry is vice-president and general manager of B F Sturtevant Co, Boston.

Leo H Rich Inc, industrial consultants, announce opening of offices at 1 Wall St, New York City. This organization claims to increase sales by correlation of economic and marketing research, industrial design and public relations.

Joseph Watterson has been appointed director of engineering at **Associated Engineers, Inc.**

Engineering Controls, Inc, is the new corporate name of the firm of manufacturing, designing and consulting engineers who have operated under name of Pacific Enterprise Products Co. Lloyd C Harbert



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A TAYLOR WATER ANALYZER
will give you
These Desirable Advantages . . .

- **CONVENIENT** . . . Eliminates use of fragile Nessler tubes and handling of individual standards
- **VERSATILE** . . . Permits accurate determinations of pH, chlorine, silica, ammonia, iron, etc.
- **TIME SAVING** . . . Many determinations can be made in less than 2 minutes
- **DEPENDABLE** . . . Liquid color standards carry an *unlimited guarantee* against fading
- **EASY OPERATION** . . . Extreme simplicity of design and operation
- **LONG LASTING** . . . Sets are sturdily built, light in weight
- **ECONOMICAL** . . . A low-cost method of control

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Contains 88 pages of detailed information — theoretical and practical. Describes Taylor methods and equipment. Gives specific recommendations for control in 34 industries. You'll use it often as a reference book. SEE YOUR DEALER OR WRITE

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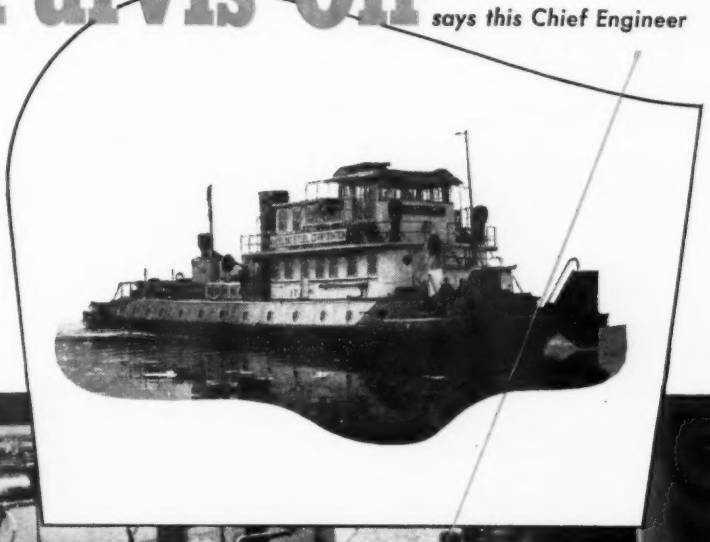
W. A. TAYLOR AND CO.
YORK & RODGERS FORGE RDS. • BALTIMORE 4, MD.

"Our engines have made an outstanding operating record with Gulf Parvis Oil" says this Chief Engineer



The "Ductillite," operated by the Wheeling Steel Corporation, which every year hauls one of the largest tonnages on the Ohio River. (Below) the Chief Engineer (right) gives a Gulf Lubrication Engineer (left) some facts on the fine performance of Gulf Parvis Oil.

"GULF Parvis Oil has been used exclusively in her engines since she was commissioned in October, 1940," says the Chief Engineer of the 'Ductillite,' "and they have made an outstanding operating record, with very low maintenance costs."

This boat is powered by two 380 H.P. four-cycle Diesels. The piston rings and cylinder walls of these engines are lubricated by oil mist and oil splash thrown by rotation of the crankshaft. Here, as in other Diesels using similar lubricating systems, Gulf Parvis Oil's greater resistance to oxidation minimizes the formation of harmful sludge which often results when oil and air are in intimate contact at high temperatures.

For maximum efficiency and lowest maintenance costs for your Diesels, call in a Gulf Lubrication Engineer and ask him to recommend the proper grade of Gulf Parvis Oil to meet your particular requirements. Write, wire, or phone your nearest Gulf office today.

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EXTRA SERVICE

"STANDCO"

PILLOW BLOCKS

There's Extra Value in these rugged, well-designed Standco Pillow Blocks with their life-long, trouble-free service.

They, are fully able to "take it," and have babbitted, accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

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"Unbrako" and "Hallowell" Products are sold entirely through distributors

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JENKINTOWN, PENNA., BOX 577
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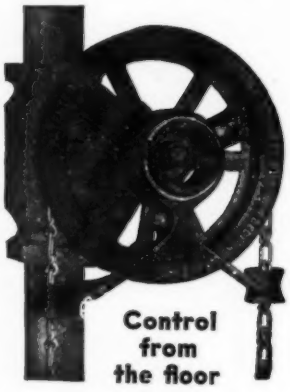
Make Your Overhead Valves SAFE and Easy to Reach---

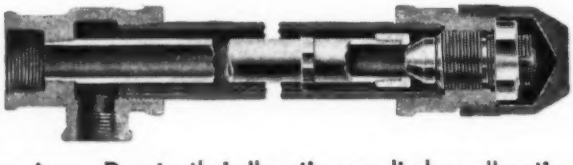


With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

QUIET PLANT NOISE
with Nicholson Expansion Traps

Quiet Operation Is a Feature of These "Continuous Discharge" Steam Traps



Elimination of violent-acting traps is a No. 1 measure in anti-noise campaigns. Due to their "continuous discharge" action, Nicholson expansion steam traps are extremely quiet. And they are entirely automatic; no air binding; no freeze-ups; discharge air as efficiently as water.

GIVE FULL CONTROL OF CONDENSATE'S TEMPERATURE

Their continuous discharge also makes these traps especially desirable where condensate is to be metered or passed at a certain temperature. Any pressure from 0 to 250 lbs. without change of valve or seat. In lengths from 18" to 40".

Send for Catalog 444 or See Sweet's

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

is now president of the new corp. William G Corey is vice-president in charge of engineering and Forrest W Monroe is secretary and treasurer. Main offices continue at 2833 E 11th St, Los Angeles.

Following officers were elected by **Industrial Unit Heater Association:** R H Nelson, president; R J Resch, vice-president; L O Monroe, secretary-treasurer. Nelson is president of Herman Nelson Corp, Moline, Ill., and Resch is president of McQuay, Inc, Minneapolis, Minn.

Eugene W Boehne has been appointed associate professor of electrical engineering at **Massachusetts Institute of Technology.** He succeeds W H Timbie, who will retire in June.

Iron and steel div of **Kaiser Co** has made W J Gleason export sales manager.

Permanente Cement Co names Frank Potts export sales manager.

Young & Rubicam, Inc, San Francisco, has been appointed by **Permanente Metals Corp** to handle national advertising of Kaiser aluminum.

Harry Neal Baum has joined **Gebhardt and Brockson,** advertising agency, Chicago.

Edwin S Bundy, vice-president and chief engineer of **Buffalo Niagara Electric Corp,** has been named a director. He succeeded Col William Kelly, former president and executive committee chairman, who retired.

New office address of **Benjamin F Cook,** consulting engineer, is 1221 Baltimore Ave, Kansas City 6, Md.

OBITUARIES

Harry C Beaver, 70, vice-chairman of board of directors and former president of Worthington Pump & Machinery Corp, Harrison, N. J., died suddenly on Apr 2.

John H Allen, 89, founder and president of Everlasting Valve Co, Jersey City, N. J., died at his home, Orange, N. J., on Feb. 18.

J J Wilson, 59, Seattle branch manager of John A Roebling's Sons Co, died Mar 6.

Paul W Chase, 46, secretary and treasurer of Chase Pump & Equipment Co, Providence, R. I., died at Central Falls, R. I., on March 22.

Francis J Gallagher, 71, engineer for Horn & Short Shoe Co, Natick, Mass., died at Framingham, Mass., Community Hospital on Mar. 23.

Frank Perrone, 57, stationary engineer at Carthage Paper Makers' plant, Carthage, N. Y., for many years, died recently.

Floyd Thompson, 46, superintendent of steam plant of Lockport div, New York State Electric & Gas Corp, died suddenly of a heart attack while attending a recent company convention in Binghamton.

Karl C Mason, 55, general superintendent of Brockton (Mass.) Edison Co, died suddenly in E Bridgewater, Mass., on Mar 16.

COFFIN TURBO PUMPS

HIGH SPEED • SINGLE STAGE

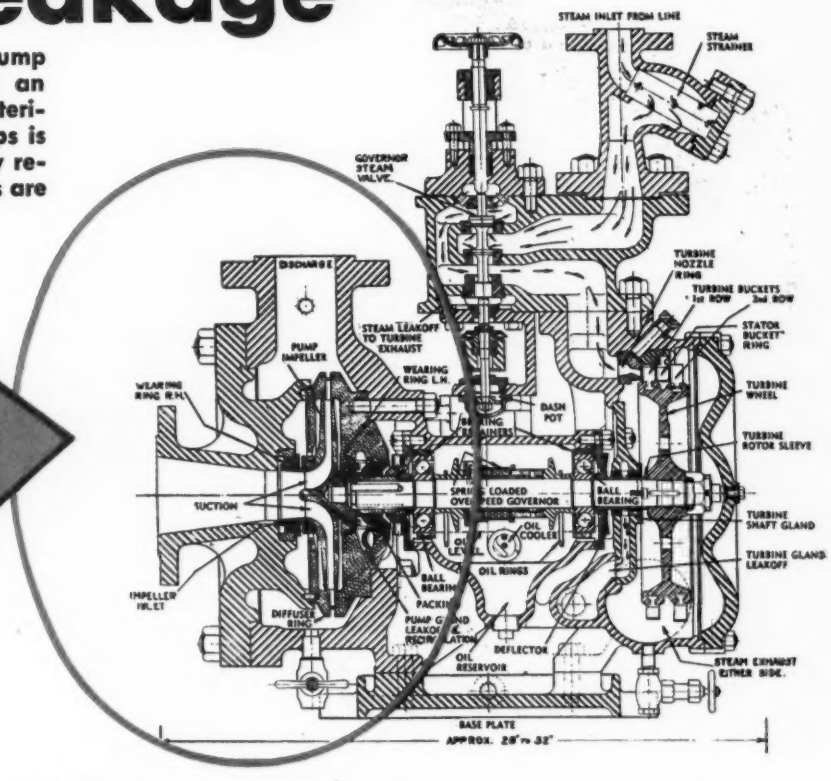
3—No Interstage Leakage

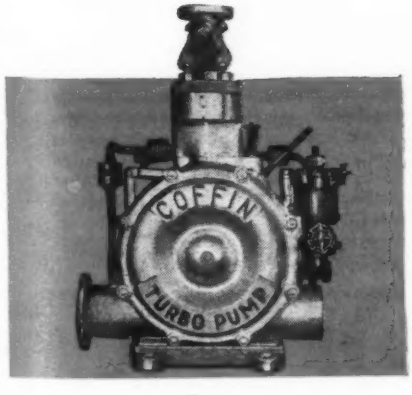
INTERSTAGE leakage in a single stage pump is impossible by definition. Hence an important cause for pressure-capacity deterioration in high pressure centrifugal pumps is ELIMINATED in Coffin designs; and costly replacements of cut or "wiredrawn" casings are never required.

thus

WITH THIS SINGLE STAGE STRUCTURE

there is no interstage leakage!





Standardized Boiler Feed Units for:

Steam Pressures to 600 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI
(Heads to 1800 feet)
Liquid Temperatures to 300 F

UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
2. No destructive casing erosion-corrosion.
3. No interstage leakage.
4. Wide range exact pressure governing.
5. Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration.
6. High efficiency pump plus high speed two-bucket row turbine results in minimum steam consumption.
7. Matched Pump, Turbine and Governors under one responsibility.
8. Exact hydraulic and mechanical balance—light weight rotor—large bearings; result: bearing troubles practically unknown.
9. Pump Gland Leakoff provides adequate recirculation; suction pressure only on packing.
10. Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation.
11. All parts made to gage and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies stocks.
12. Proved for performance over a period of more than twenty years in service.
13. Compact, light in weight, quiet and low in maintenance.

Literature sent on request; specific proposals on receipt of operating data.

INDUSTRIAL RAILROAD COFFIN MARINE PRODUCTS

Representatives in Principal Cities

The J.S.COFFIN, JR., CO. 326 South Dean St. ENGLEWOOD, N.J.

POSITIVE DISPLACEMENT
POSITIVE PERFORMANCE

Two IMO pumps employed for supplying hydraulic pressure oil to a combustion control system.

THE DE LAVAL-IMO PUMP is a rotary, positive displacement pump of unique design having *only three moving parts*—a power rotor and two idler rotors. Pump output is uniform at all pressures, making an ideal unit for hydraulic, fuel and governor services.

For further information ask for catalog I-136 P.

IMO means I MOVE OIL

IMO PUMP DIVISION
of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

NEW TECHNIQUE . . .
SANDWICH ADHESION

Joins METALS, PLASTICS, RUBBER, GLASS

SOLVES YOUR ADHESIVE PROBLEMS

Materials joined with Plasgon "Sandwich Adhesion" withstand a shearing stress of over 200 pounds per square inch!

Send for your free sample and try this yourself . . .

Spread Plasgon, the plastic adhesive, over each surface. No heating or preparation necessary. "Sandwich" a piece of kraft paper or fabric between surfaces and press firmly together. In 48 hours you'll have a tough permanent joint . . . proof against heat, oil, gas, water . . . flexible so that shock or jarring can not weaken it.

If you or your customers have a difficult adhesive problem, let us show you how to solve it with Plasgon. Samuel Cabot, Inc., 1607 Oliver Bldg., Boston 9, Mass.

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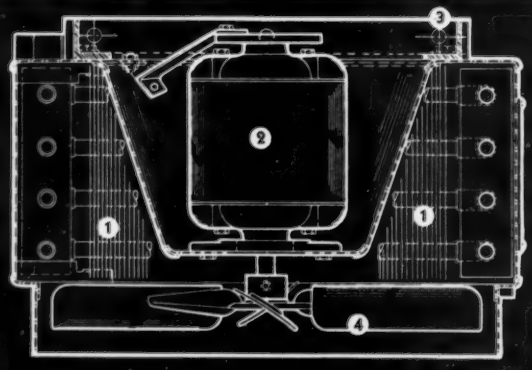
For the tremendous demand for
DUNHAM UNIT HEATERS

- RUGGED CONSTRUCTION
- COMPACT; FLEXIBLE
- FLOOR, WALL OR CEILING TYPE
- EFFICIENT—NOT EXPENSIVE



TYPE C

1 HEATING ELEMENT — non-ferrous—designed for balanced steam travel in all tubes—tested hydrostatically at 400 lb psi—suitable for working pressures up to 150 lb psi—designed to provide correct discharged air temperatures at low or high working pressure.

2 MOTOR—ball bearing, grease packed—trouble free—resiliently mounted to isolate vibration and noise.

3 CASING—streamlined in the modern manner—heavy steel with rounded corners—rigidly welded for freedom from vibration and drumming noise.

4 FAN—slow speed (1140 rpm maximum) for quiet operation—draws air through heating element and forces it down to working areas for uniform efficient temperatures. A diffuser fitting makes proper distribution.

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INDUSTRIAL UNIT HEATER ASSOCIATION
HEAT WITH UNIT HEATERS

Combines the latest modern design with characteristic Dunham precision engineering . . that's why Dunham Unit Heaters provide year-in, year-out trouble-free operation. These improved Unit Heaters meet the requirements of all industrial and commercial applications, supply fresh or recirculated air, heated and distributed evenly throughout the area. Adjustable dampers on Type 'R' regulate air volume easily and accurately. Adjustable louvres on Type 'V' discharge air at varying angles in accordance with room needs. Dunham Unit Heaters provide uniform heat distribution and equalize temperature differences between floor and ceiling. Write for new, comprehensive bulletin; C. A. DUNHAM CO., 450 E. Ohio St., Chicago 11, Ill.

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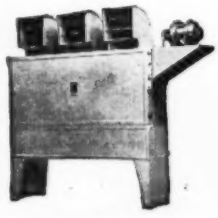
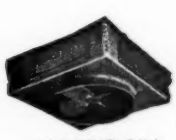
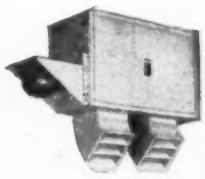


FLOOR TYPE R

TYPE V



"DOWNFLO" TYPE C



INVERTED WALL TYPE R

DUNHAM HEATING MEANS BETTER HEATING

The Man in the Field KNOWS when Pre-Fabricated Piping is Right

Men in the field who erect piping know when shop fabrication is well done . . . they know if the sub-assemblies fit correctly, line up easily and have all field welds or flanged joints in accessible positions. When this is the case, the erecting job is easier . . . saves both time and money.

Midwest has a Construction Department which has erected piping of all kinds for 46 years. The critical attitude of this department is the best stimulant to our four pipe-fabricating plants. The Construction Department also frequently contributes useful and practical suggestions for improving pipe fabrication.

This situation has a powerful effect in keeping the whole organization alert . . . and in encouraging continuous improvement. It is one of many reasons why you get the best when you buy Midwest Pre-Fabricated Piping . . . either as materials furnished or piping completely installed.

MIDWEST

CONTRACTING DEPARTMENT *Checks*

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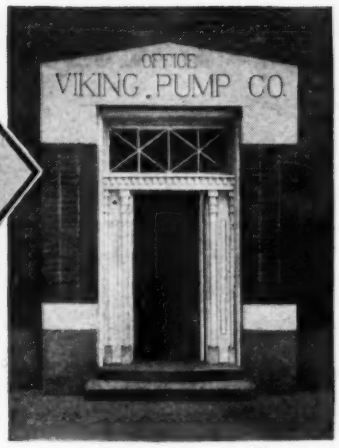
2266

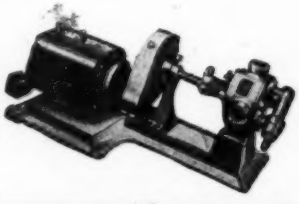
A Good Place To Take Your PUMPING PROBLEMS



It's a good idea to take your rotary pumping problems to the leader in the field . . . Viking Pump Company. Here, your problem will be solved, based on the experience of many others . . . and with a choice of pumps from a complete range of models and sizes. There is no sacrificing the right pump for your job because of a short line of rotary pumps.

In addition, a complete sales and engineering service is available at many principal cities. Direct factory offices and outstanding, well-informed representatives are ready to serve you.

Weigh the facts before making your decision. Write today for folder 46SW and ask for complete recommendations on your pumping problem.



VIKING PUMPS — FIRST IN AMERICA

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VIKING Pump COMPANY
CEDAR FALLS, IOWA

HAERING ORGANIC GLUCOSATES control SCALE, CORROSION and ALGAE in INDUSTRIAL PLANTS

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SEE WHY K.A.T. IS

THE SIMPLEST

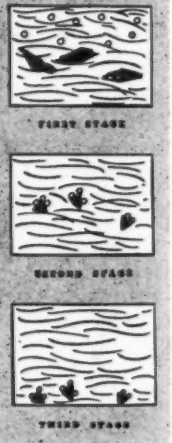
MOST EFFECTIVE

WATER TREATMENT KNOWN

K.A.T. ALL-COLLOIDAL WATER TREATMENT

Most water treatments depend on chemical reaction. The secret of K.A.T. is colloidal action. Whereas certain chemicals remove particular impurities and additional treatments must be used for remaining impurities, K.A.T.'s colloidal action attracts and removes all impurities. (See illustrations below.)

Since colloidal action is entirely physical, K.A.T. works for all waters regardless of composition. K.A.T. prevents scale accumulation • Removes existing scale • Inhibits corrosion • Minimizes outages • Safeguards steam purity • Slashes fuel, labor, maintenance costs • Permits almost continuous operation of boilers.



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Works For All Waters As A Complete or "Finishing" Treatment

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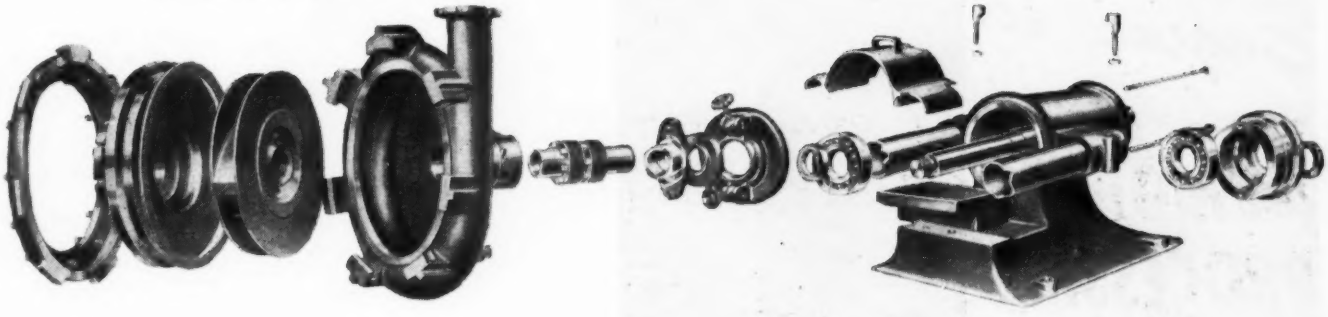
2-WAY REDUCTION IN MAINTENANCE PROBLEMS

WITH

AMSCO-NAGLE INDUSTRIAL PUMPS



TOUGH JOBS DON'T FAZE AMSCO-NAGLE

Pump-punishing removal of ashes poses a maintenance problem — it's simplified in this large midwestern power plant by installing an Amsco-Nagle, "8", Type "T", Ball Bearing Industrial Pump as shown above. Less maintenance required because design and materials are pointed at maximum service under toughest operating conditions. Maintenance, when required, is reduced to simplest form by accessibility of all parts. Write for bulletins.

REDUCTION NO. 1
LESS MAINTENANCE

Maximum service life assured with Amsco-Nagle Pumps because they're designed to resist abrasion, and impact. Wide impeller clearances pass debris-laden liquids. Only casing, impeller, end plate contact material being pumped. Anti-friction bearings completely sealed off from water end. Manganese steel impellers and casings used for unequalled resistance to impact and abrasion.

REDUCTION NO. 2
EASIER MAINTENANCE

Accessibility of all parts simplifies maintenance — reduces non-operating time to a minimum. End plate attaches with clamping ring or dogs, impeller screws on. Supporting tubes on water end slip into sleeves on bearing housing. Stuffing box quickly reached from above or below, between supporting tubes.

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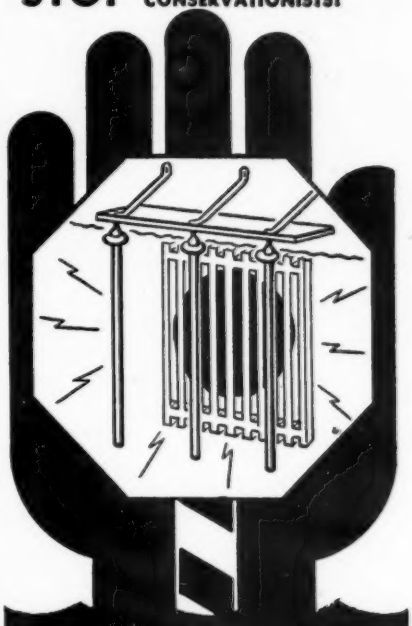

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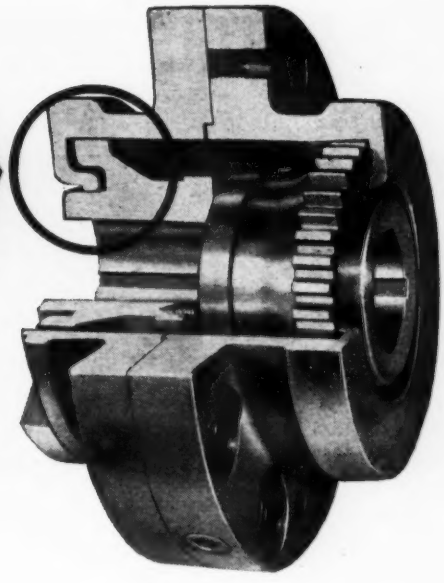

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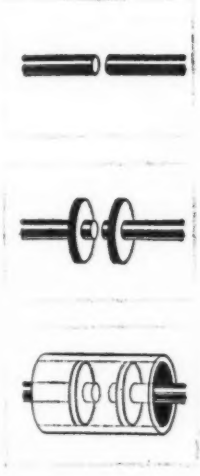

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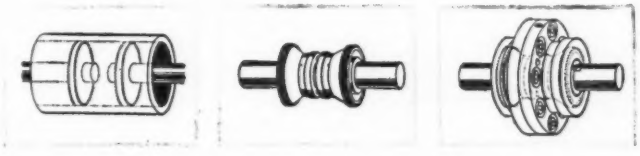

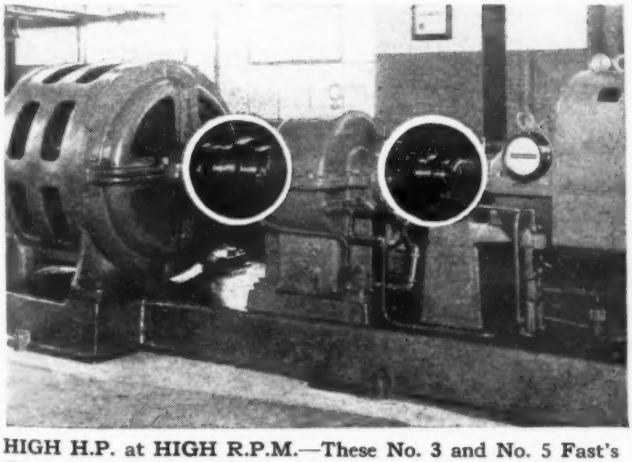

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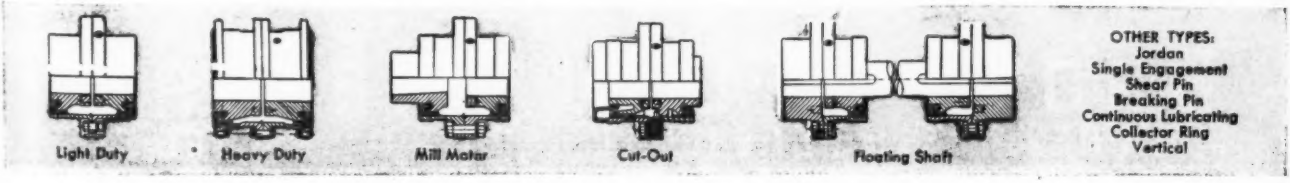

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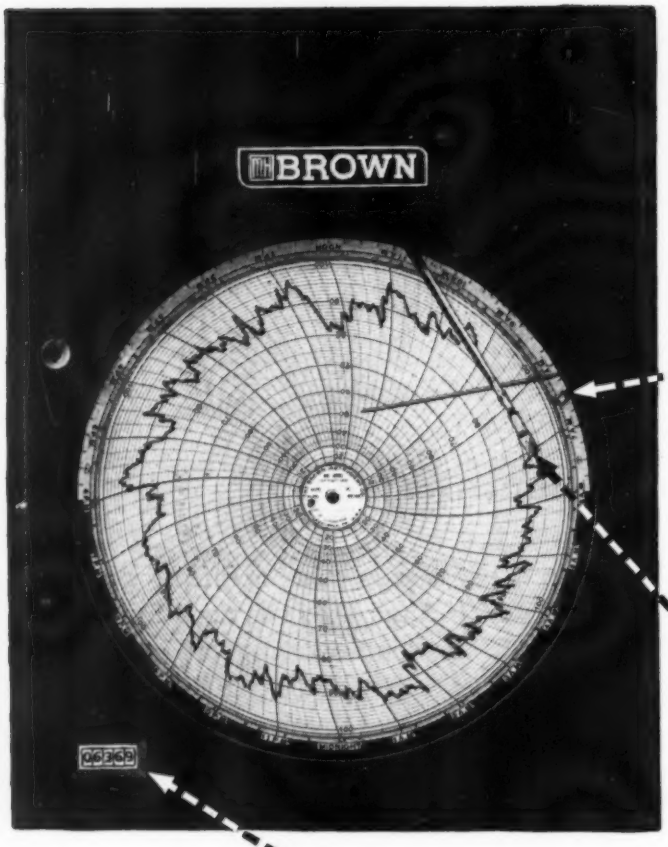

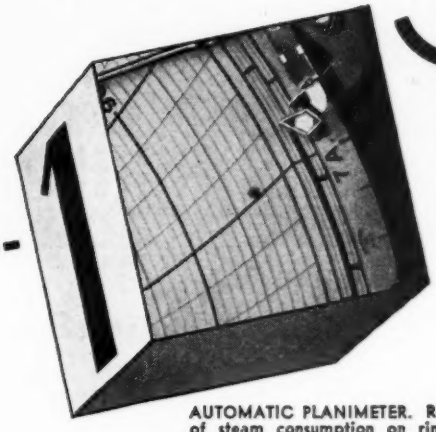

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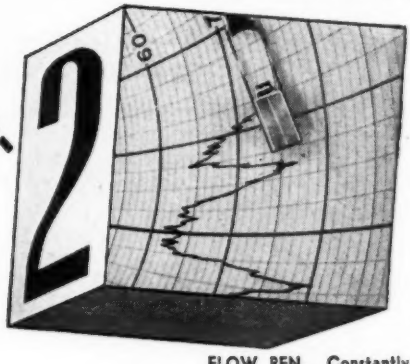

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ANY system of steam accounting worthy of the name requires knowledge of three basic facts: How much steam is produced (or used); When it is used; What is the total amount for any period.

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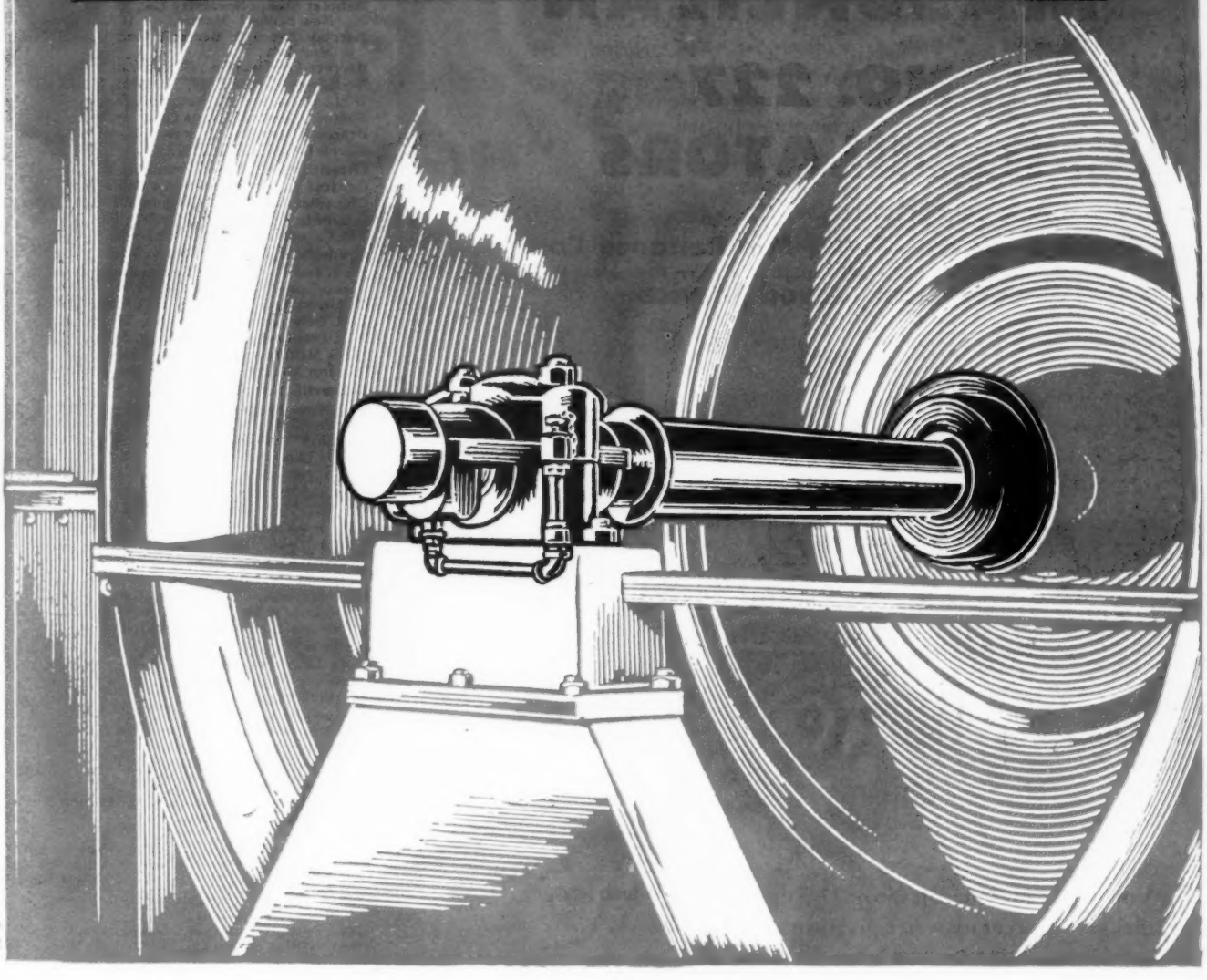

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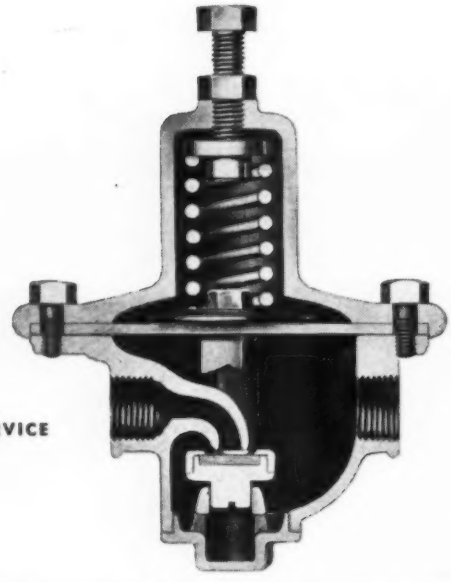

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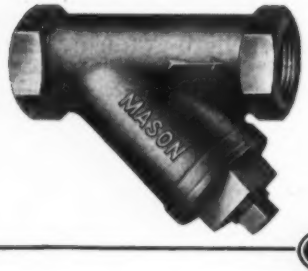

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Every Inch G-W Design

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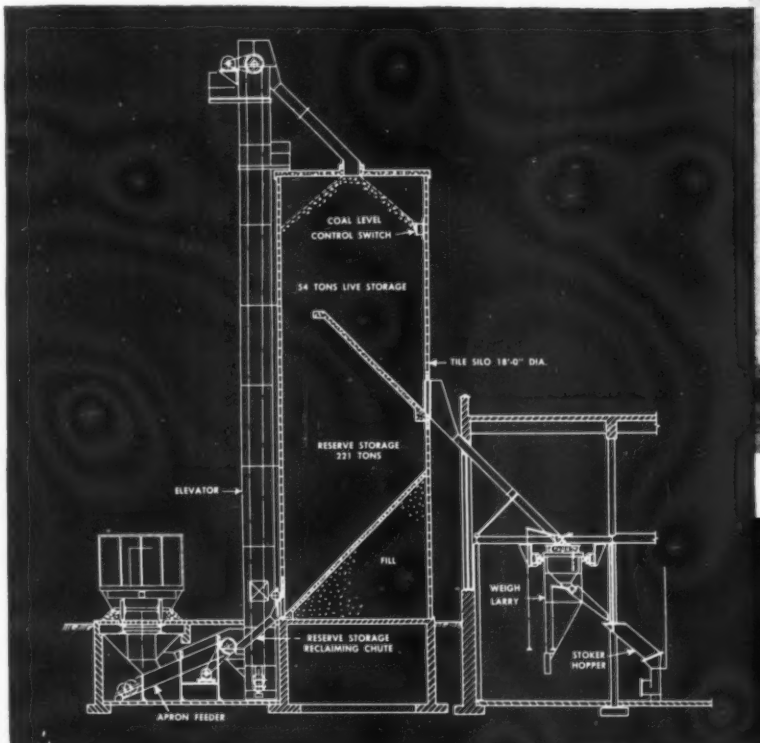
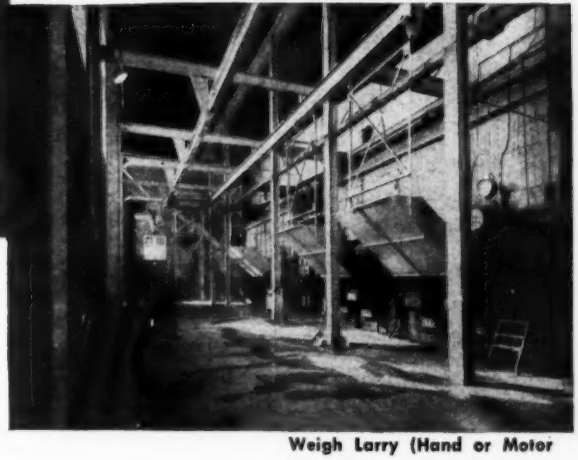
Completely mechanical, this system handles bituminous stoker-size coal from hopper-bottom cars to stoker hoppers in boiler room, with minimum labor. It's in service at the Veterans Administration, Fort Custer, Mich. The whole design was conceived by G-W . . . all the mechanical equipment furnished by G-W.

The G-W *plan* of centralized responsibility saves time and money, speeds the whole project.

On coal-handling problems like this – or on those that vastly differ – the straightest line to efficient solution runs right through a Gifford-Wood office. For complete engineering service, contact the one nearest you.



G-W Bucket Elevator and Vitrified Tile Silo with Live and Reserve Storage.



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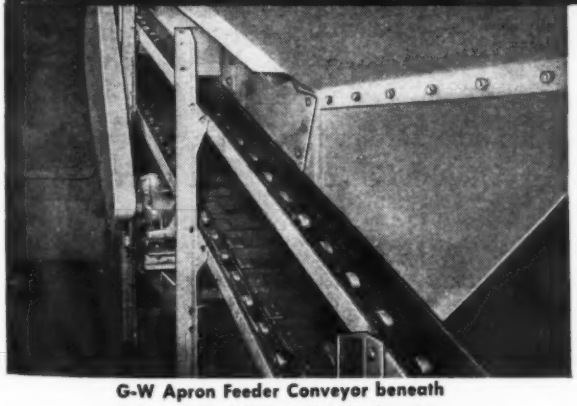

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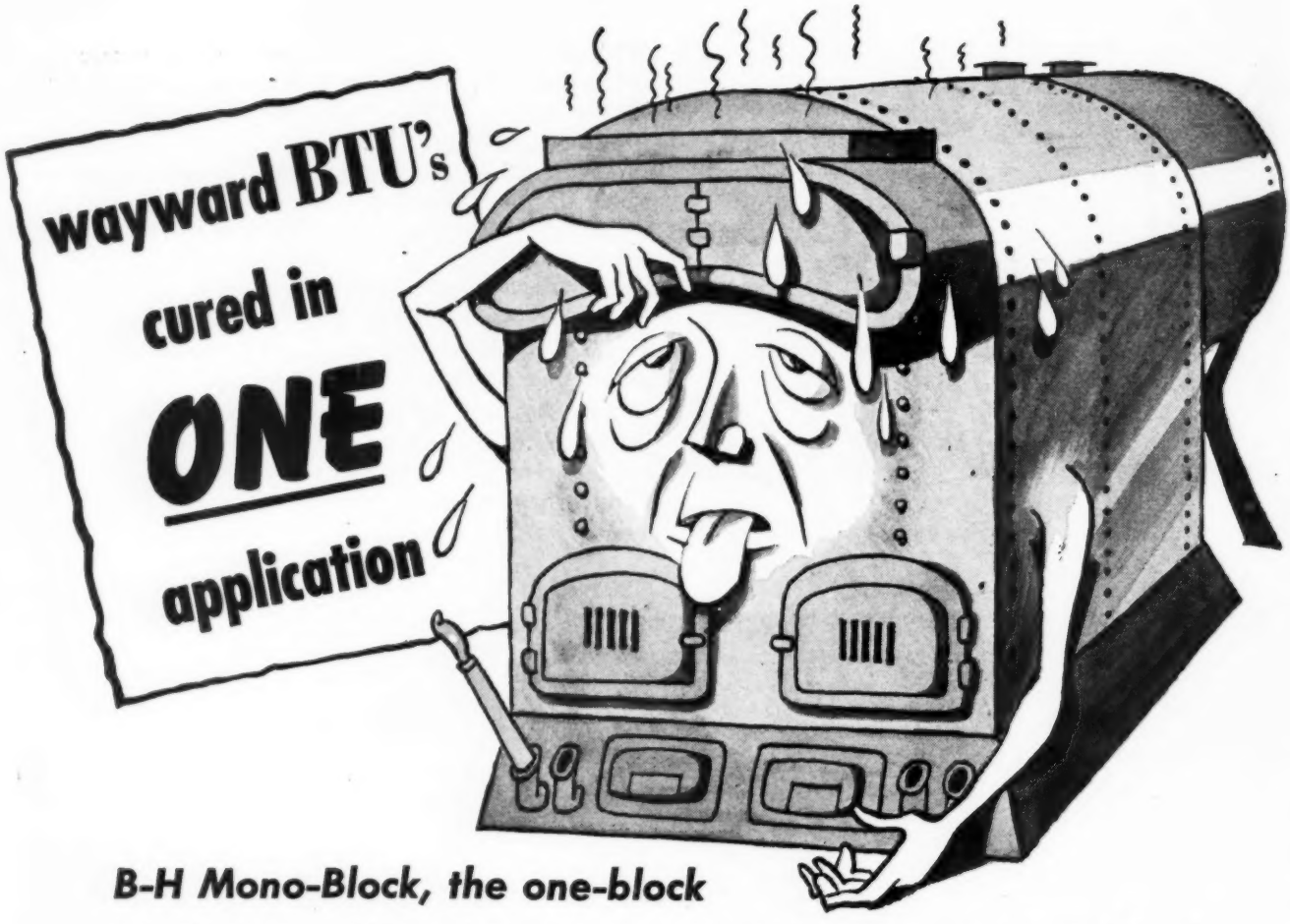

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So, if heat loss from equipment is costing you money, send for full information and a sample of B-H Mono-Block.

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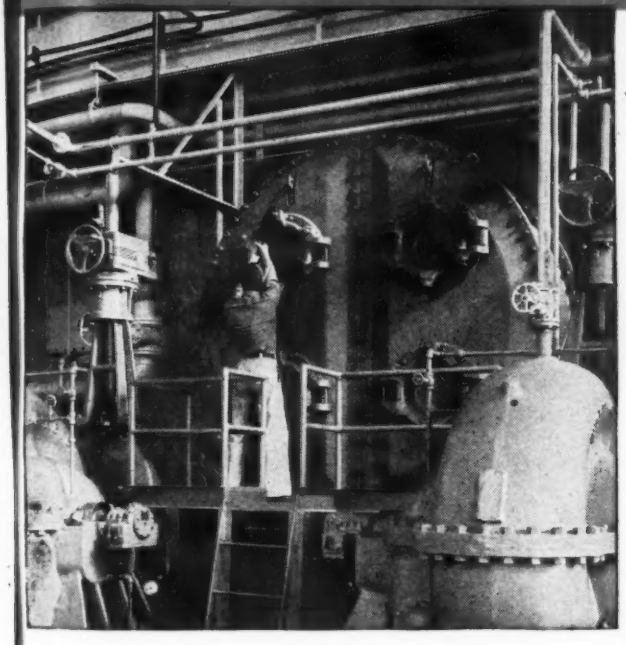


Original efficiency restored

—with Dowell chemical cleaning

Leading engineers, responsible for power plant efficiency, have found in Dowell's *chemical* cleaning service a modern method for *reducing costs*. They know that more efficient operation of boilers, condensers and other heat-exchange equipment is achieved easily after chemical scale removal service. Power plant operators can see for themselves how safe, how rapid, how effective this tested process really is—when applied by *specialists* in chemical cleaning.

Dowell engineers fill the equipment with liquid solvents designed to dissolve and disintegrate the accumulated scale and sludge. They are experienced in practical methods, know which solvents to use, and bring with them adequate equipment—special truck-mounted tanks, pumps, mixers, heaters—for complete control of each stage in the successful job. To save dismantling and down time—to reduce operating costs—call Dowell. Ask for "More Power To America's Industry!" —free color booklet showing how Dowell service engineers use chemicals to clean steam generating equipment, heat-exchangers, water lines, water wells, cooling jackets and many other types of equipment.

DOWELL INCORPORATED • TULSA 3, OKLAHOMA

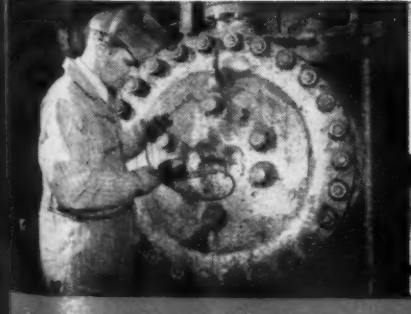
New York, Philadelphia, Boston, Baltimore, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis, Kansas City, Wichita, Oklahoma City, Houston, Fort Worth, Shreveport, Mt. Pleasant, Mich.; Salem, Ill.; Borger, Texas; Wichita Falls, Texas; Midland, Texas; Lafayette, La.

Long Beach, Casper: Dowell Associate—International Cementers, Inc.

Dowell's industrial engineers are thoroughly experienced in successful chemical cleaning. They are supported by the full research and technical resources of Dowell's own laboratories.

Dowell's field equipment includes the most modern types of scientific devices. Solvents for Dowell chemical scale removal service are mixed especially to fit each individual job.

FREE SHOWING! *New 18-minute sound slide film illustrating the possibilities of Dowell Chemical Scale Removal Service. To arrange a special showing call or write Dowell.*



DOWELL

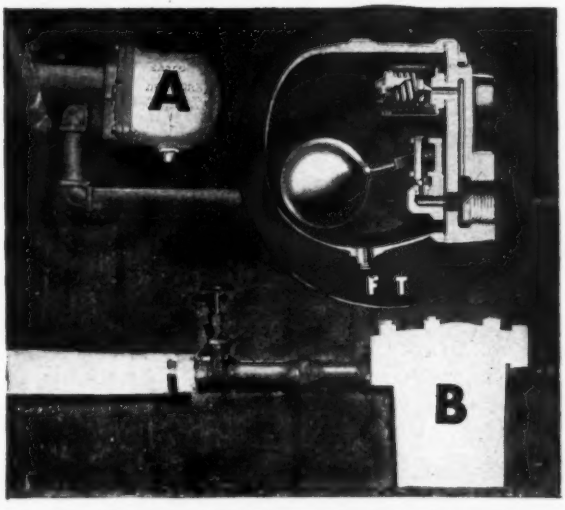
FOR INDUSTRIAL CHEMICAL SERVICE

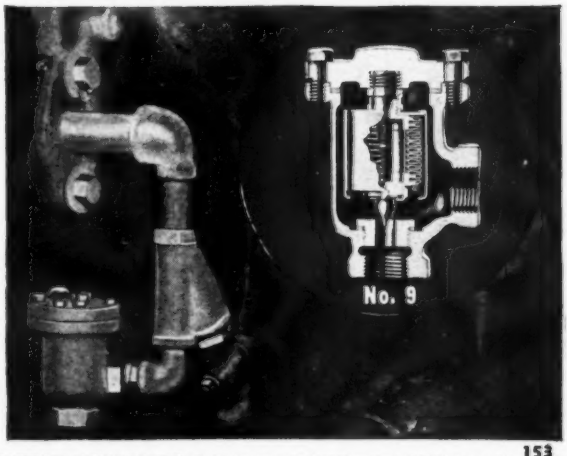
"NEXT TIME WE WILL GET THE RIGHT TRAP—FIRST"

This 300 barrel brew kettle never did work right with the large old fashioned steam traps originally installed (see illustration "B" at right). When plant output was stepped up something had to be done. The small inexpensive Sarco Float-Thermostatic Trap(A) now drains the largest coil in the kettle and everything is OK.

On the large bottle washing machines, two other types of traps were tried without success, and then all troubles were ended with the new Sarco No. 9 Thermostatic Steam Trap shown at the right. The Brewmaster has decided that hereafter he will see Sarco first.

It costs no more—actually much less in the long run, to get the right combination of steam traps and temperature control. Sarco makes all types—a family of products that works together on any specific job. The Sarco Representative can show you how.





153

SARCO SAVES STEAM

SARCO COMPANY, INC.
Represented in Principal Cities
475 FIFTH AVE., NEW YORK 17, N. Y.
SARCO CANADA, LTD., TORONTO 3, ONTARIO

Because they are

5 TIMES AS FLEXIBLE!

Interior View of Tangent Shown Above Clearly Illustrates Uniformity of Corrugations. (Actual size—24" O.D. x ⅜" wall thickness.)

CORRUGATED TANGENTS

Save Space, Relieve Stresses, and Simplify Operation

PITTSBURGH Piping and Equipment Company Corrugated Tangents are at least five times as flexible as a piece of straight pipe of the same length, diameter, and wall thickness.

Their proper use permits more convenient location of valves, makes possible the use of shorter lines without causing excessive stresses or end reactions against equipment, and provides a more compact, dependable system.

This type of piping, in suitable applications, can be used to advantage when replacing, improving, enlarging, or installing a complete new piping system.

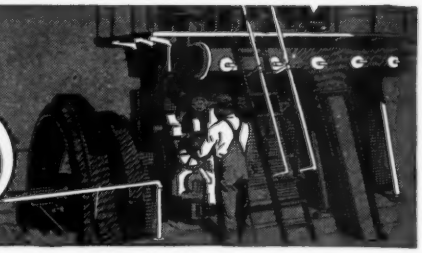
Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Chamber of Commerce Bldg., Indianapolis
Book Tower, Detroit
525 Market Street, San Francisco
315 West 9th Street, Los Angeles
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston
Whitehead Building, Atlanta

STANDARD ENGINEERS NOTEBOOK



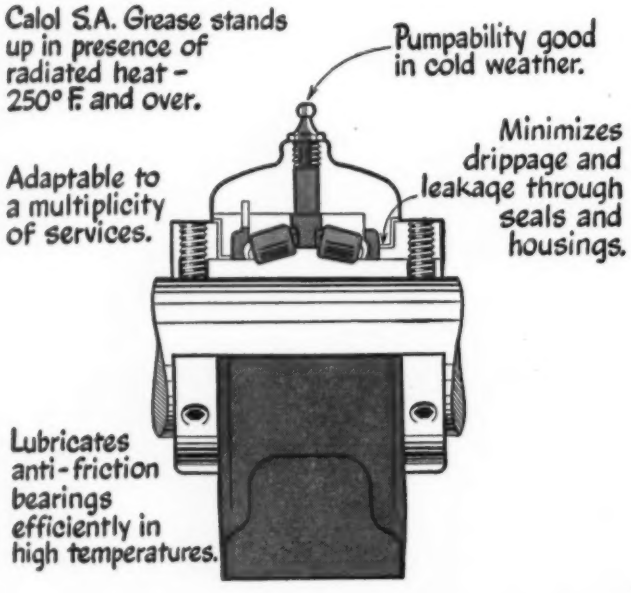
More positive lubrication in high temperatures

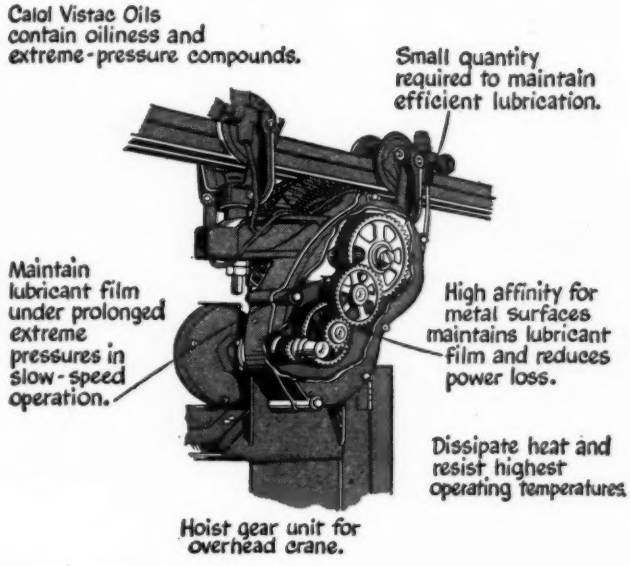
Drippage and leakage from bearings that must operate in high ambient temperatures can be materially reduced by using Calol S. A. Grease.

This special grease is made from a sodium-aluminum base and selected oils with high heat-resistant qualities. In many instances it has provided satisfactory lubrication where bearing temperatures, due to radiated heat, are as high as 250°F. and over. It can be applied easily in all seasons as it has good pumpability in cold weather.

Calol S. A. Grease can be adapted to a great many services in various industries. It was, however, originally developed for anti-friction bearings. Tests in the field and on the Navy Ball Bearing Machine have proved it excellent for low-, medium-, and high-speed bearings of the anti-friction type.

There are three grades of Calol S. A. Grease: No. 00, No. 0 and No. 1. It is packed in 35-, 108- and 420-pound containers.


Calol S.A. Grease stands up in presence of radiated heat – 250° F. and over.
Pumpability good in cold weather.
Minimizes drippage and leakage through seals and housings.
Adaptable to a multiplicity of services.
Lubricates anti-friction bearings efficiently in high temperatures.


Calol Vistac Oils contain oiliness and extreme-pressure compounds.
Small quantity required to maintain efficient lubrication.
Maintain lubricant film under prolonged extreme pressures in slow-speed operation.
High affinity for metal surfaces maintains lubricant film and reduces power loss.
Dissipate heat and resist highest operating temperatures.
Hoist gear unit for overhead crane.

Viscous and tacky oils keep tough film on gears

Heavy duty gears, such as industrial reduction sets, with forced-feed or gravity lubricators, sight-feed cups, bottle- or wick-oilers are safely lubricated with Calol Vistac Oils.

As the name "Vistac" implies, these oils are both viscous and tacky and have a high affinity for metal surfaces. They contain oiliness and extreme-pressure additives and provide a lubricant film of unusual strength. This film resists rupture even on slow-moving gears that develop extreme pressures over a wide area for a relatively long time.

In addition to being outstanding gear lubricants, Calol Vistac Oils are excellent for air hammers, rock drills and other air tools. They rapidly carry away heat, resist high temperatures, stay fluid at low temperatures and atomize quickly. There are six viscosity grades of Calol Vistac Oils:

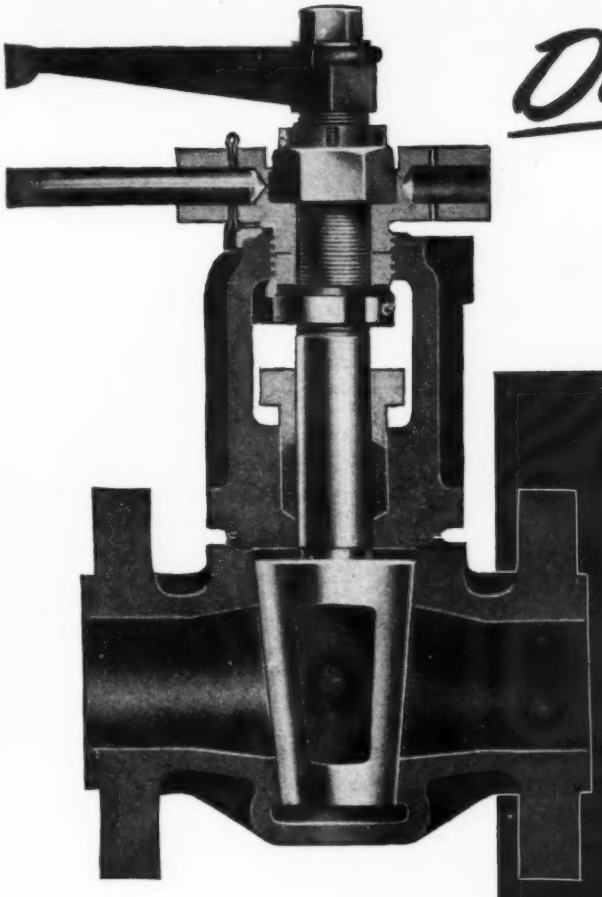
9X (SAE 10), 14X (SAE 20), 19X (SAE 30), 28X (SAE 40), 36X (SAE 40), 45X (SAE 40).

Trademarks "Calol," "Vistac," Reg. U. S. Pat. Off.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

ELIMINATE VALVE FAILURES



Due to CORROSION TEMPERATURE AND PRESSURE EXTREMES

with HOMESTEAD LEVER-SEALD VALVES

They're Stick proof... Here's Why:

1. **INSTANT STICK-PROOF OPERATION.**
2. **Quarter-turn fully opens or closes.**
3. **Positive mechanical seal.**
4. **Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.**
5. **Unobstructed straight-line fluid flow.**
6. **All operating parts protected from damaging effects of service conditions and weather.**

Built into every valve is a *powerful lever-and-screw device* which relieves seating pressure between valve plug and body just enough to prevent friction and permit *easy turning at all times and under all conditions.* This exclusive LEVER-SEALD mechanism assures never-failing stick-proof operation no matter what the line contents are or how long the valve has remained in an open or closed position. Operation is positive even at temperatures as low as 40° below Zero or as high as 1120°Fahrenheit, at pressures from vacuum to 1500 pounds. The absolute reliability of HOMESTEAD LEVER-SEALD VALVE operation has kept them favorites for over 15 years, for difficult applications where temperature extremes, pressure and the corrosive action of line fluids render ordinary valves inoperative.

HOMESTEAD LEVER-SEALD VALVES are made in combinations of metals and alloys, such as stainless steel, Monel Metal, Ampco Metal. Ni-Resist, Durimet, etc., to meet your service requirements in sizes 1½" to 10". Write for complete details and Valve Reference Book No. 38.

HOMESTEAD LEVER-SEALD VALVES

HOMESTEAD VALVE MANUFACTURING CO. • P. O. BOX 210 CORAOPOLIS, PENNA.

NO OTHER EXPANSION JOINT IS LIKE IT

E. B. Badger & Sons Company is the original and sole manufacturer of BADGER Expansion Joints

DIRECTED FLEXING equalizing rings are a *patented* — hence exclusive — feature of Badger Packless Corrugated Expansion Joints. In combination with another Badger feature —ALL-CURVE corrugations—they "harness" expansion, contraction and vibration stresses more dependably, more economically, more permanently than any other known means of handling this vital pipeline problem.

Excessive stresses in high-temperature or high-pressure lines simply can't get out of hand. They can't pile up in pockets or junctions—because Badger *ALL-CURVE Corrugations* have no pockets or junctions. Then, *ALL-CURVE Directed Flexing Rings* complete the even distribution of stresses — among all the corrugations of the joint — and furthermore provide a fixed safety limit to movement and pressure.

Badger Packless Directed Flexing Corrugated Expansion Joints are built with known factors that leave nothing to guesswork. You can readily determine the number of corrugations needed, since the maximum traverse per corrugation is consistent for each size. For example:

Diameter	*Depth of Corrugation*	*Traverse per Corrugation*
4" and 5"	1⅛"	5/16"
6"	1¾"	½"
8" and 10"	2¼"	⅝"
12" and larger	2¾"	¾"

MADE IN COPPER, STAINLESS STEEL AND OTHER ALLOYS — Copper for normal pressures and temperatures; Stainless Steel and other alloys for higher requirements — and where corrosion is a problem. Single or multiple corrugations — for traverses from a fraction of an inch upward. Also made in Non-equalizing type (without rings) for uses that do not require added protection. SEND FOR BULLETIN No. 100 (*Self-equalizing*) or No. 200 (*Non-equalizing*).

Badger

E. B. BADGER & SONS CO., 75 Pitts Street, Boston 14, Mass.

AGENTS IN PRINCIPAL CITIES

PACKLESS CORRUGATED EXPANSION JOINTS

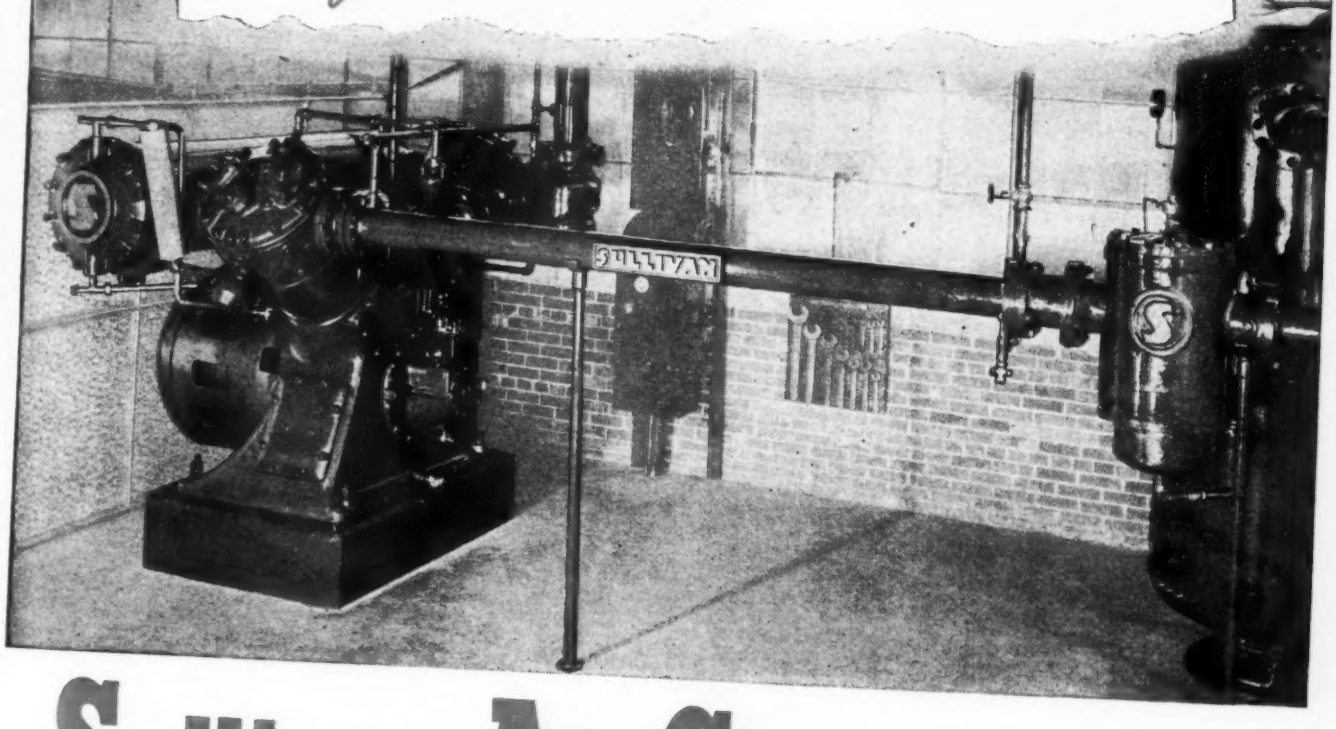
SPACE SAVER

THAT PROVIDES LOW-COST COMPRESSED AIR

SERIES WN-112
for capacities of 378 to 1828 cfm, pressures up to 125 psi

If space is precious in your plant, that's one more reason why you'll want to specify the Sullivan WN-112 Compressor. It's more compact than other compressors of equivalent capacity because of its advanced design and use of alloy metals—and it operates more economically . . . gives longer heavy duty service. Installation is simple, and maintenance low.

For full details write for bulletin A-52



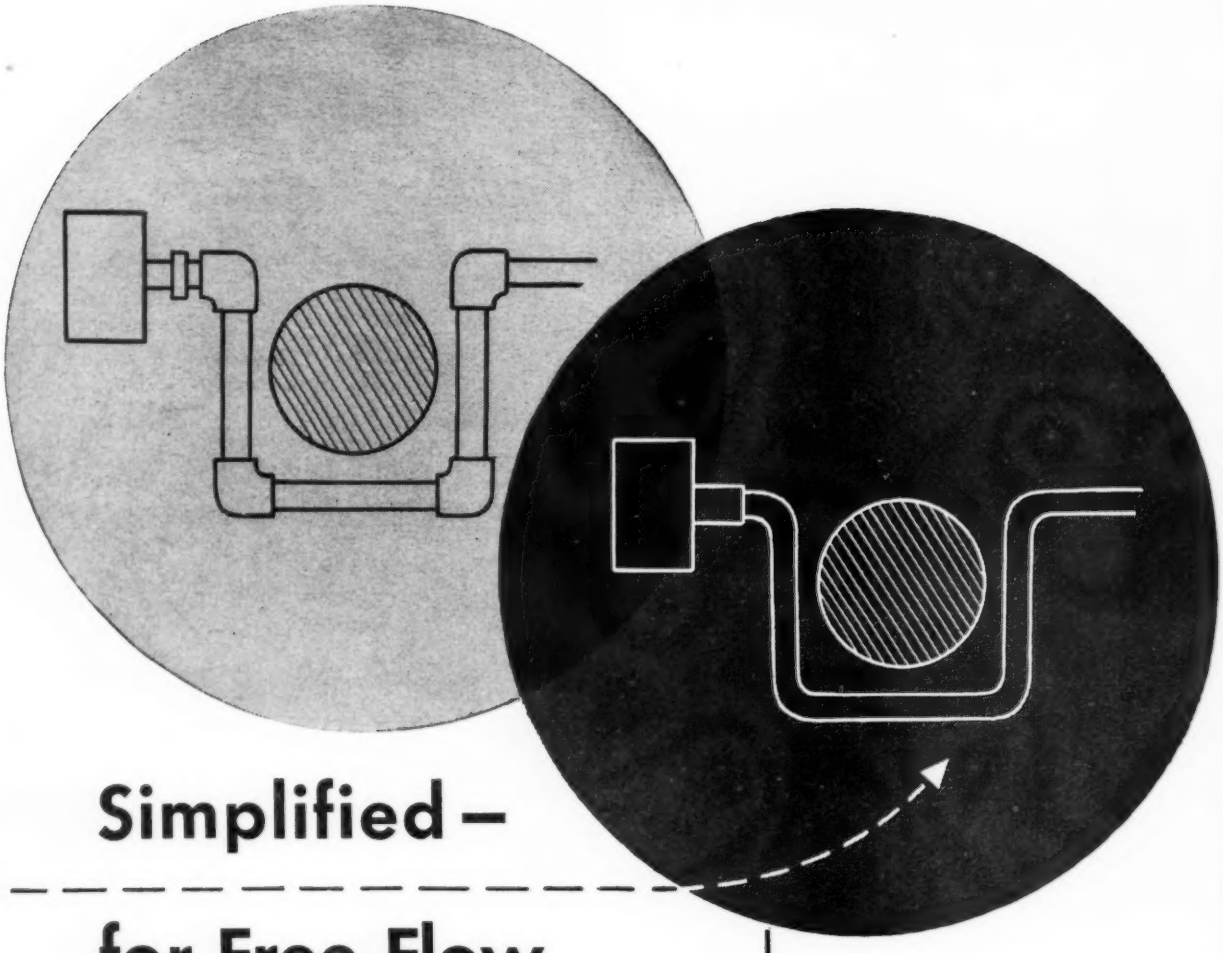
Sullivan Air Compressors

PORTABLE AND STATIONARY — ¼ HP TO 600 HP
ALWAYS DEPENDABLE!

Consult a Joy Engineer

W&D 1512

SULLIVAN DIVISION
JOY MANUFACTURING CO.
GENERAL OFFICES: HENRY W. OLIVER BLDG., PITTSBURGH, PA.



Simplified—

for Free Flow

Easy to bend, tubing goes wherever you want it—around corners—into tight places . . . with *fewer fittings*—fewer chances for leakage. Assembly and maintenance are quicker—easier.

Tubing systems, engineered with PARKER Fittings and Valves, insure Free Flow, with fewer obstructions and less turbulence. They take less space—and weigh less.

If you have fluids to move—either liquids or gases . . . under high or low pressure—you can do it better using tubing with PARKER Fittings and Valves. Available from conveniently located warehouses and distributors.

Let's talk it over.

THE PARKER APPLIANCE COMPANY
17325 Euclid Avenue • Cleveland 12, Ohio
Offices: New York, Chicago, Los Angeles, Dallas, Atlanta
Distributors in Principal Cities

Parker
TUBE FITTINGS • VALVES

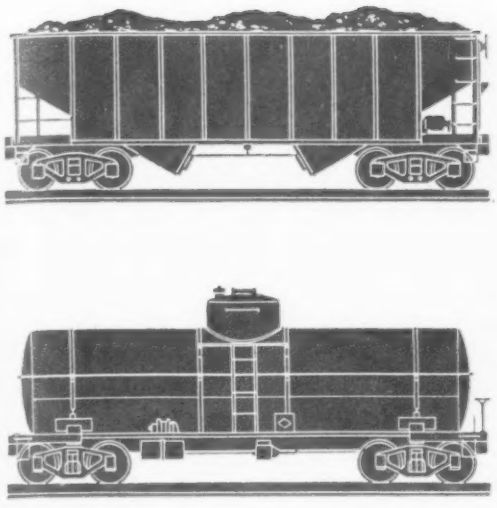
THIS
PARKER TUBE FITTING
MAKES FREE-FLOW
SYSTEMS POSSIBLE

With this Tube Fitting—as with all PARKER Fittings and Valves—pressure-tight and leakproof connections are assured.

Threading is all on the fitting—you can use heavy or light *bendable* tubing—steel, stainless, light metal or brass.

All PARKER Fittings are ***precision-made***—easy to install or remove, and every PARKER Fitting is a *coupling*.

Write for Bulletin A-48, reviewing PARKER Products.



changing fuels IN YOUR POWER PLANT?

It's No Problem to users of ENCO OIL BURNERS with COAL FIRED UNITS

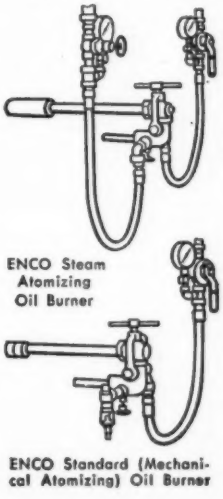
Coal—oil—or both if necessary; changing fuels is no problem if your power plant is equipped with ENCO Oil Burners in combination with coal burning units. Your operations need only be governed by availability of fuels and comparative BTU costs.

ENCO Burners, designed for use with or without air registers and for natural or forced draft, are made in various sizes with capacities from 10 to 1,000 gallons per hour. Mechanical and steam atomizers may be used interchangeably to provide a wide load range from cold starting to full load operation.

With Pulverized Coal Burners either ENCO Mechanical or Steam Atomizers are used for ignition and entire load range. Bulletin OB-PC, giving complete details on use of ENCO Oil Burners with pulverized coal will be sent on request.

from coal to oil and back to coal if necessary!

With Stoker or Hand-Fired Units, this same combination of oil burners with coal fired units can be used with either Steam or Mechanical Atomizer for partial or full loads. Complete information on either temporary or permanent installations of this type will be sent on request.



ENCO Steam Atomizing Oil Burner

ENCO Standard (Mechanical Atomizing) Oil Burner

EC-468

THE ENGINEER COMPANY
Also Produces
Enco Streamline Baffles
Enco Oil and Gas Burning Equipment
Enco Fuel Oil Pumping and Heating Units
Enco Automatic Combustion Control

THE ENGINEER COMPANY

75 West Street, New York 6, N. Y.
Canadian Representative
F. J. Raskin Ltd., 370 Rachel E., Montreal, P. Q.

GILMER HAS THE PULL

Gilmer

KABLE KORD FLAT ENDLESS BELT

the famous "two belts in one"

WHEN you want a tough, highly flexible flat belt that delivers maximum power and stands up long in hard, continuous service, choose the famous "two belts in one" (contactor and power) . . . the Gilmer Kable Kord Flat Endless Belt.

Contactor cords, at top of belt, exert pressure on the lower power section, squeezing the belt firmly against pulleys. This unique Gilmer design provides one belt for *grip* and one belt for *pull*. Together they produce a belt that is both highly flexible and *stretch resistant*. This special construction, plus the wear-resistant Kable Kord jacket, makes the belt well suited for a wide range of applications including many *difficult* drives.

Supplied in a wide range of sizes and in six weights, from light to triple-heavy.

On these fixed centers there has been no take-up in two years at the time photograph was taken.

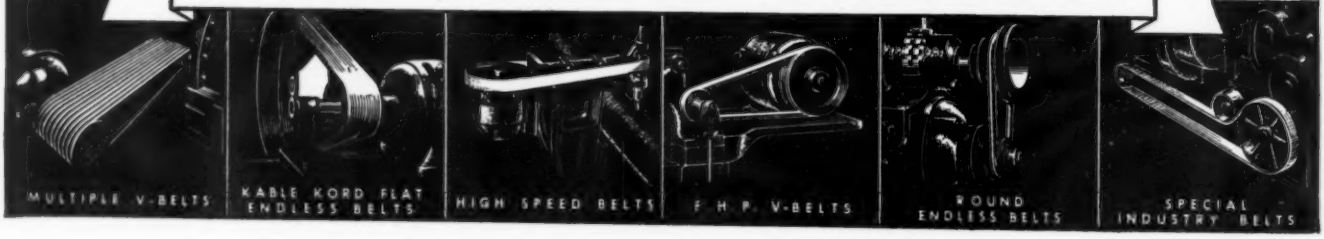
L. H. GILMER COMPANY, Tacony, Phila. 35, Pa.
Division of United States Rubber Company

Call your local Gilmer Distributor.

Gilmer BELTS

GILMER KABLE KORD BELTING is supplied in rolls of 250 and 500 feet. Construction provides a firm base for any standard connector or rawhide lacing.

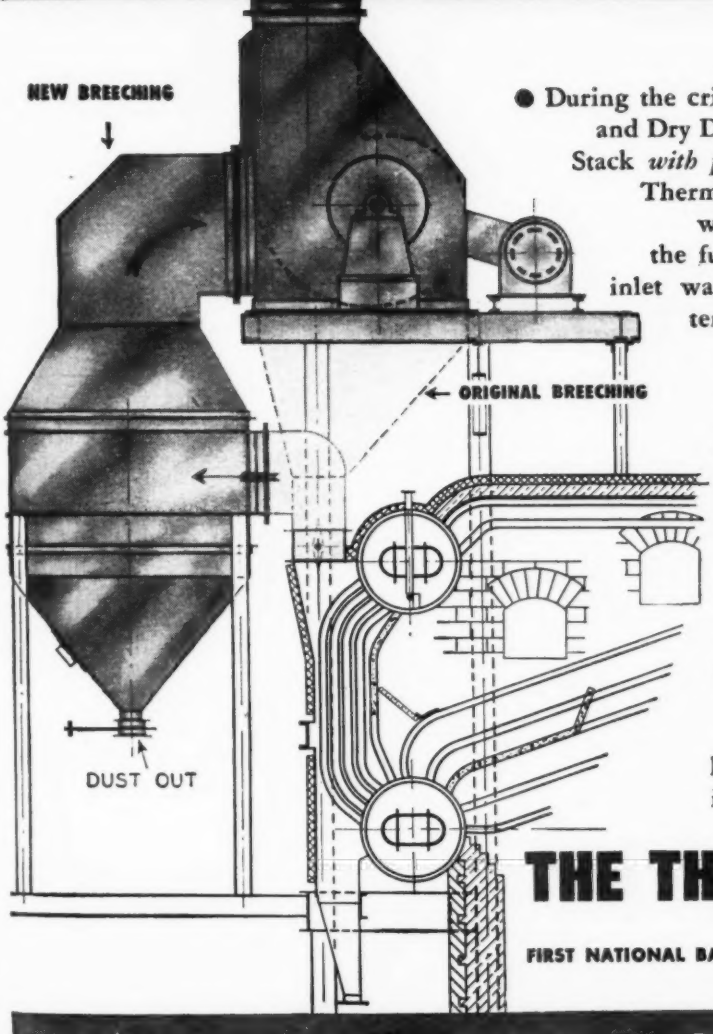
THERE IS A GILMER POWER TRANSMISSION BELT FOR EVERY NEED



The Federal Shipbuilding and Dry Dock Co.

ENGINEERED for the FUTURE

—Have You?



● During the critical shortage of steel, the Federal Shipbuilding and Dry Dock Company of New Jersey installed a Thermix Stack *with provisions for a dust collector at a future date.* A Thermix Fan Stack with both a side and bottom inlet was used. The side inlet was blanked off for use in the future installation of the dust collector; the bottom inlet was directly connected to the boiler outlet. This temporary breeching, from the boiler to the ID fan, is indicated in the illustration by dotted lines.

Now that steel is available, the Thermix Tubular Dust Collector has been added to the original stack installation. Placing it in operation necessitated only the removal of the duct from boiler to stack and connection of collector to boiler and side inlet of the fan. The original bottom inlet of the fan was then blanked off.

Thermix collectors have the distinct advantage of both flexibility and extremely high collection efficiencies over a wide range.

Call on our project engineers, the Thermix Corporation, for more detailed information on how your plant equipment can be designed and installed to permit future additions.

THE THERMIX CORPORATION

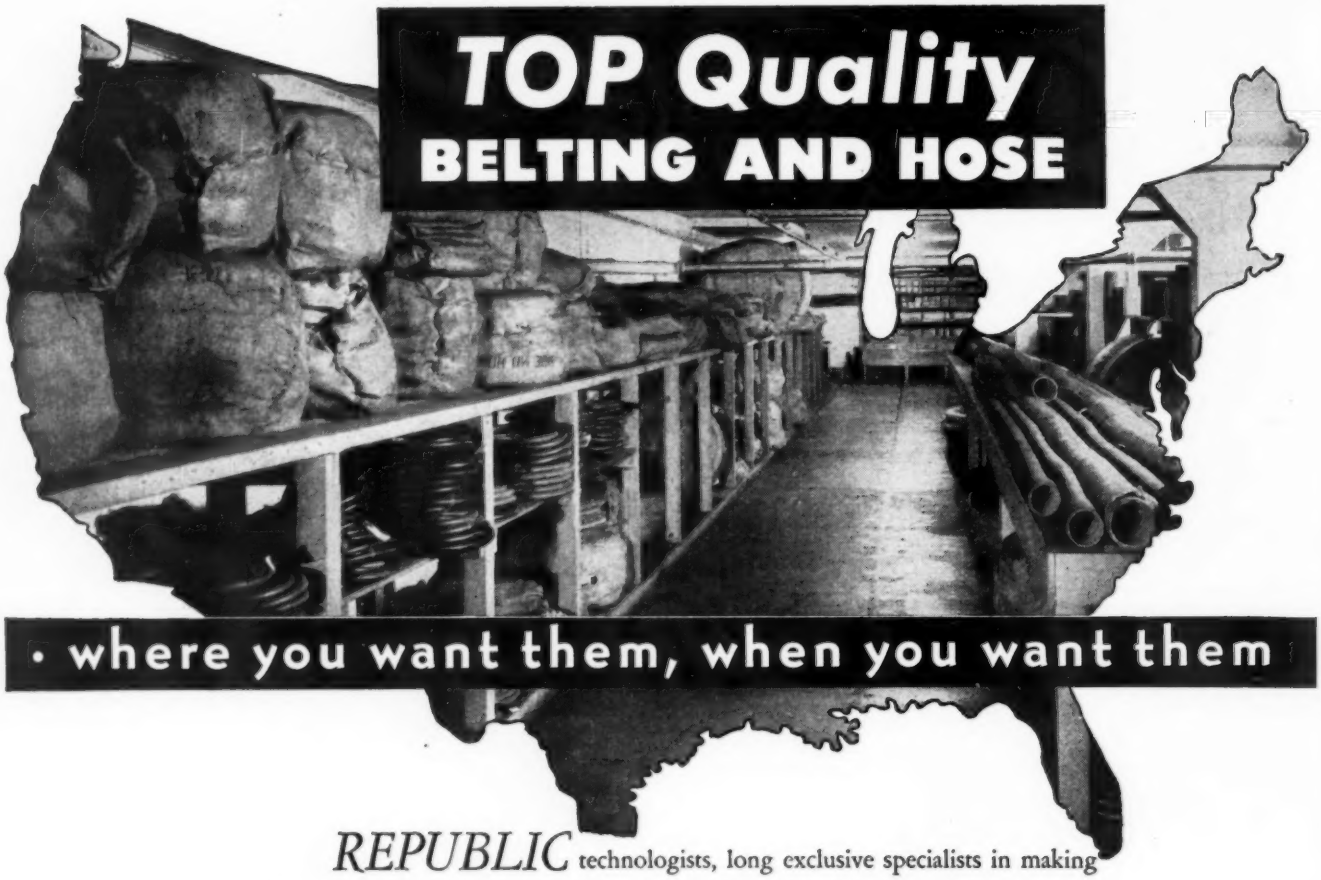
Project and Sales Engineers

FIRST NATIONAL BANK BLDG. GREENWICH, CONN.

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

TOP Quality
BELTING AND HOSE



• where you want them, when you want them

REPUBLIC technologists, long exclusive specialists in making rubber serve industry, have the know-how to build superior service into Republic Rubber Belting and Hose. Through one of the most progressive manufacturer's programs of technical cooperation and training ever established, your Republic Distributor has acquired a knowledge of his stocks that is your best assurance of getting the most out of these products. With your cooperation in determining specific operating conditions, he becomes completely equipped to recommend the right types and grades of rubber belting and hose for your needs. Coupled with his ability to make prompt, time and money-saving delivery, he represents an unparalleled source of supply on your requirements. Why not talk it over with your Republic Distributor?

MORE SERVICE FROM RUBBER FOR INDUSTRY

REPUBLIC RUBBER
DIVISION
LEE RUBBER & TIRE CORPORATION
YOUNGSTOWN 1, OHIO

REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN O

LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.

60 FACTORY BRANCHES FROM COAST TO COAST

WITH any product you use, you're after just one thing—RESULTS. That means the manufacturer's responsibility goes far beyond simply offering a good product. With Honeywell, this responsibility is accepted by service that begins when a job is in the plan stage, follows through at the time of installation—and Honeywell service carries on throughout the life of every installation to assure performance at the high standards to which every Honeywell product is made. To provide such service, Honeywell has 60 offices in the United States and Canada staffed with factory-trained engineers.

Today, most Honeywell modulating electric and pneumatic controls are available for *immediate delivery.* Specify Honeywell for your next control installation. This improved delivery service is insurance against delays. And remember that always on call is Honeywell service—the kind of comprehensive service that characterizes the leader in any field. Write or phone the Honeywell branch in or near your city. Minneapolis-Honeywell Regulator Co., 2607 Fourth Ave. So., Minneapolis 8, Minn. Canadian Plant: Toronto 12, Ontario.

MINNEAPOLIS
Honeywell
CONTROL SYSTEMS

FLEXTOOTH
(PATENTED)
CRUSHER

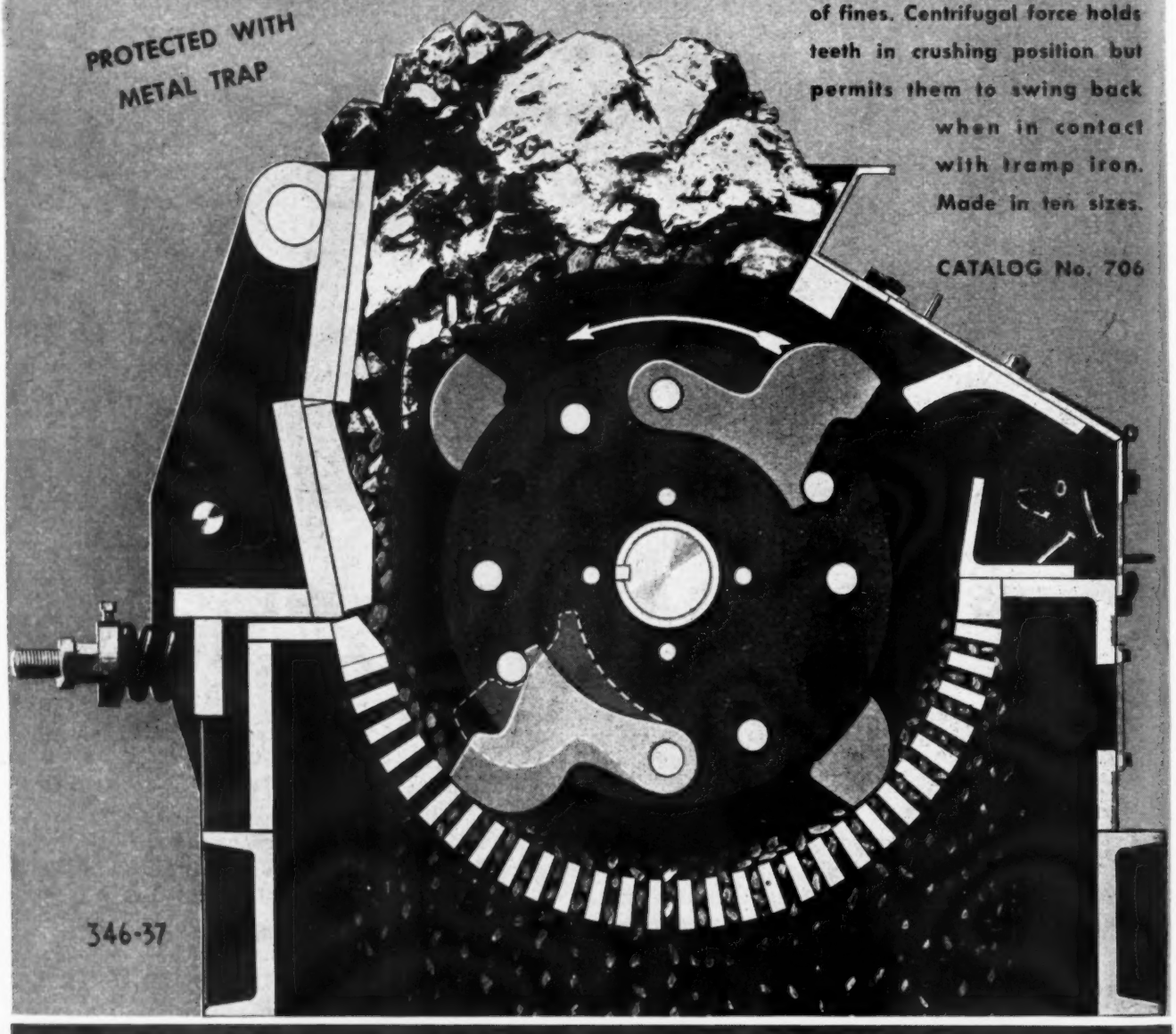
ADJUSTABLE FOR SIZED PRODUCTS

FROM 2" TO ¼" MINUS

PROTECTED WITH METAL TRAP

Reduces run-of-mine coal to either a high or low percentage of fines. Centrifugal force holds teeth in crushing position but permits them to swing back when in contact with tramp iron. Made in ten sizes.

CATALOG No. 706



346-37

THE JEFFREY MANUFACTURING COMPANY

823-77 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

Do You Need a High-Strength Alloy to Resist Corrosion?

One of these grades of HASTELLOY Alloy may be what you require

	HASTELLOY A	HASTELLOY B	HASTELLOY C	HASTELLOY D
Composition:	nickel-molybdenum-iron	nickel-molybdenum-iron	nickel-molybdenum-chromium-iron	nickel and silicon
Excellent Resistance To:	hydrochloric and sulphuric acid	boiling hydrochloric acid and wet hydrochloric acid gas	free chlorine, acid solutions of ferric and cupric salts, and sulphuric acid	sulphuric acid of all concentrations up to the boiling point
Good Resistance to:	phosphoric, acetic, formic, and other organic acids	sulphuric acid	hydrochloric and nitric acid	phosphoric acid
Available Forms:	castings, forgings hot-rolled bars, strip, plate, sheet, rods, wire, welded tubing	castings, forgings, hot-rolled bars, strip, plate sheet, rods, wire, welded tubing, cast or drawn welding rods	castings, plate, sheet, welded tubing, cast welding rods	castings, cast welding rods

Write us for samples and test them under your own operating conditions

Test coupons of these alloys are available without charge upon request... in sheet and cast form. In requesting samples, any information you can give us about the corrosive media, the type of equipment, or other conditions of service will help us choose the proper alloys to send to you.

HASTELLOY TRADE-MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

General Office and Works UCC Kokomo, Indiana

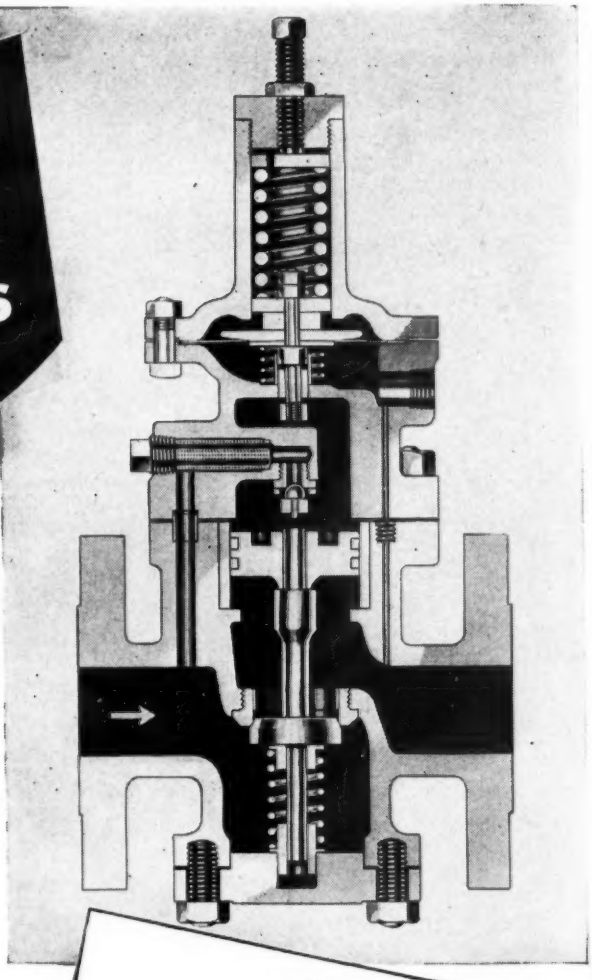
Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa

HIGH-STRENGTH NICKEL-BASE ALLOYS FOR CORROSION RESISTANCE

"Hastelloy" is a registered trade-mark of Haynes Stellite Company.

Accurate Pressure Control with

GENUINE
STRONG
IMPROVED
Regulating Valves
STEAM • AIR • GAS



For Sensitive Pressure Regulation, Use This Single-Seated, Pilot-Controlled Valve!

Recommended especially for:

- **Processes with intermittent or fluctuating demand;**
- **Processes requiring extremely sensitive control;**
- **Applications where dependability is essential.**

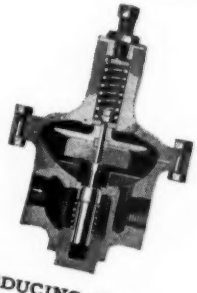
STRONG Type C Valve, illustrated at right, available in semisteel or cast steel, for pressures to 400 psi (600° F.). With ANUM-METL* seats and discs, optional internal or external pilot control, this valve automatically adjusts itself to maintain accurate reduced pressure.

Completeness of the STRONG line—steam traps, vacuum traps, pressure regulating valves, strainers, separators, continuous blowdown valves and other steam specialties—enables us to recommend exactly the right type and size for your particular application. Write us about your problem and ask for the new STRONG Regulating Valve Catalog No. 155.

STRONG "Quick-Cleaning" Strainers

STRONG improved strainers, of semisteel or cast steel construction, protect reducing valves, steam traps, control equipment, etc., by taking out scale, dirt and sediment. Available in "T" or "Y" types.

STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio



TYPE K REDUCING VALVES are direct operated, single seated and of extra heavy semisteel construction suitable for pressures to 225 psi (400° F.). Features ANUM-METL seat and disc and internal strainer. For steam, air, water or gas.

*Trade Mark Registered.

REG. TRADE MARK

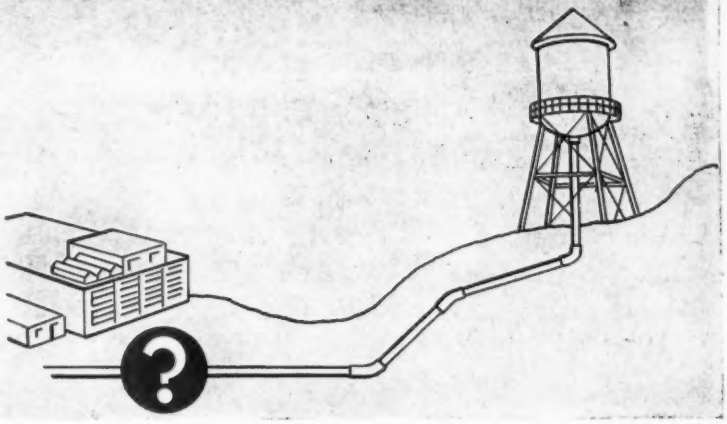
OTHER STRONG STEAM SPECIALTIES

ANUM-METL Reg. Trade Mark

Blast Trap | No. 80 Series Trap | Large Capacity Trap

PROBLEM: A textile mill uses the municipal water supply which provides 25 lbs. pressure. The mill requires a minimum pressure of 75 lbs. and will consume a maximum of 300 G.P.M. A motor driven booster pump is required to lift water to their standpipe located on a hillside near their plant.

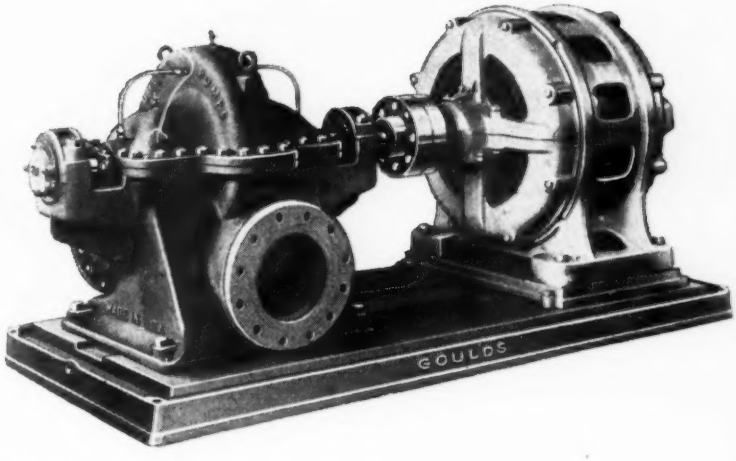
Which Goulds Pump is *the* Pump for *the* Job?



SOLUTION: GOULDS FIG. 3450 DOUBLE SUCTION CENTRIFUGAL

The 3″ size with a 15 H.P. motor gives years of heavy duty, trouble-free continuous service with a minimum of upkeep. The Goulds Double Suction Centrifugal is efficient and dependable. The initial cost is relatively low.

Made in sizes from 2″ to 16″ with capacities from 80 to 14,500 G.P.M. and heads to 500 ft., depending upon capacities. When *you* have a pumping problem, call or write Pump Headquarters or your nearest Goulds office.

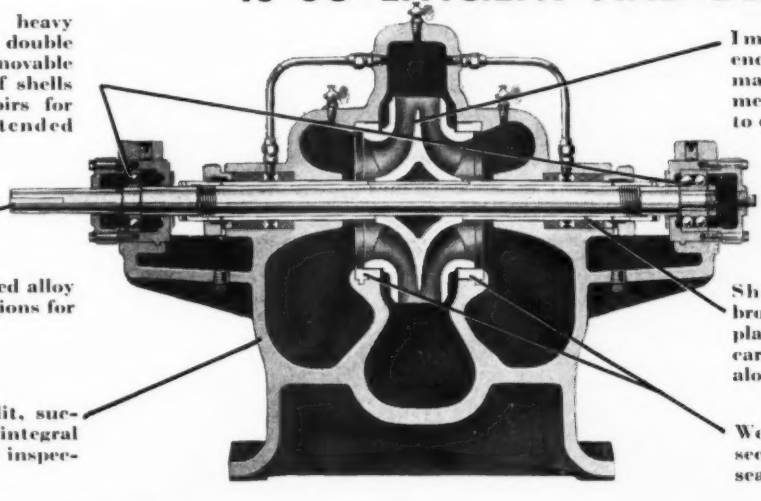


Here is why Goulds Double Suction Centrifugal *IS* SO EFFICIENT AND DEPENDABLE . . .

Bearings—deep groove, heavy duty ball bearings with double row at thrust end. Removable moisture and dust proof shells provide large oil reservoirs for long periods of unattended service.

Shaft—heavy, heat treated alloy steel of generous proportions for rigidity and long life.

Casing—horizontally split, suction and discharge cast integral with lower half for easy inspection and repair.



Impeller—high efficiency enclosed double suction type machined bronze, balanced both mechanically and hydraulically to eliminate vibration.

Shaft Sleeve—heavy section bronze easily assembled or replaced. Special triangular Micarta packing to prevent leakage along shaft.

Wearing rings—bronze, locked securely in position for effective sealing. Renewable at low cost.

GOULDS

GOULDS PUMPS, INC. • SENECA FALLS, N.Y.

PUMPS, INC.

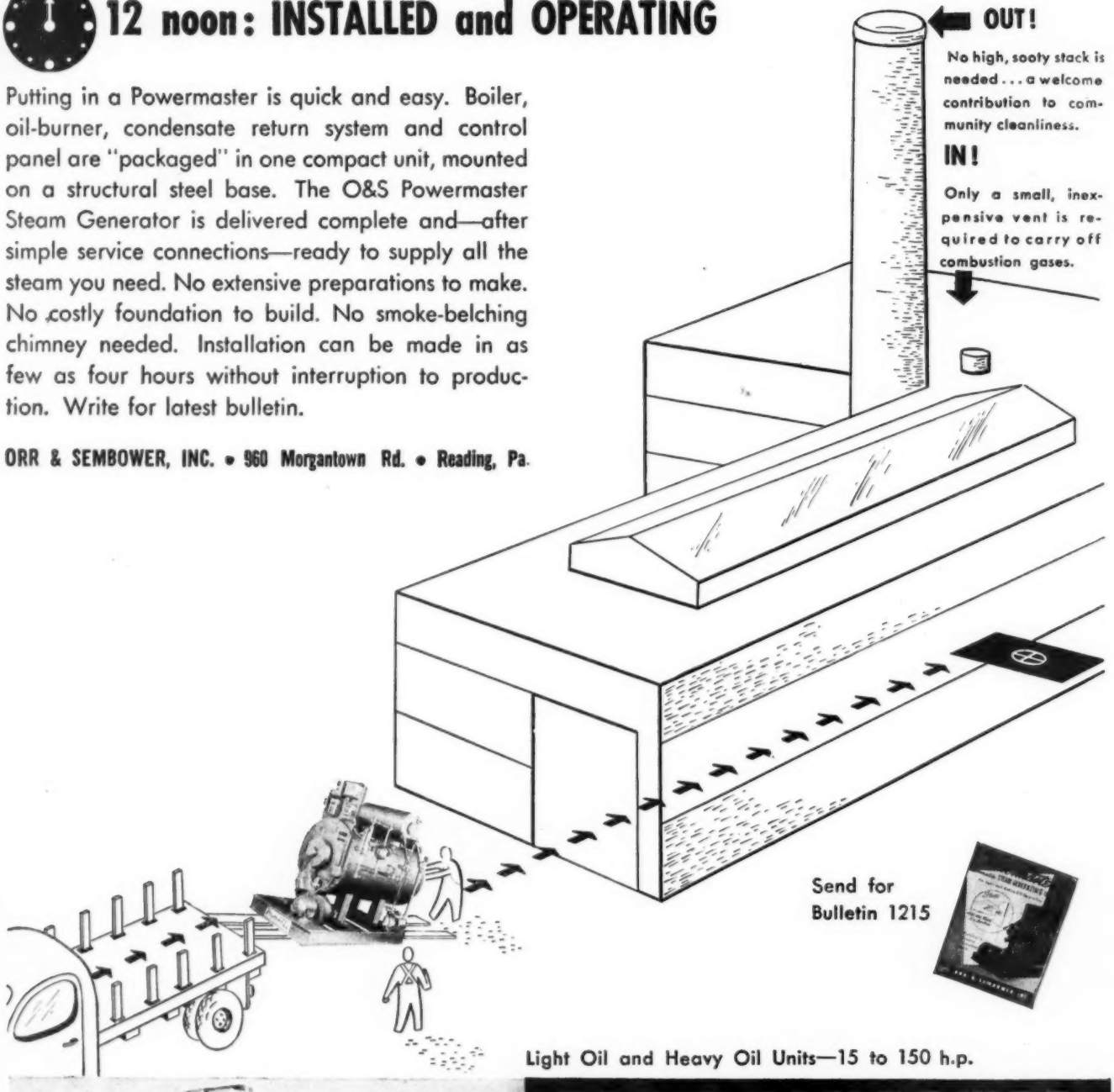
the PUMP FOR *the* JOB

6 a. m. : POWERMASTER DELIVERED

12 noon: INSTALLED and OPERATING

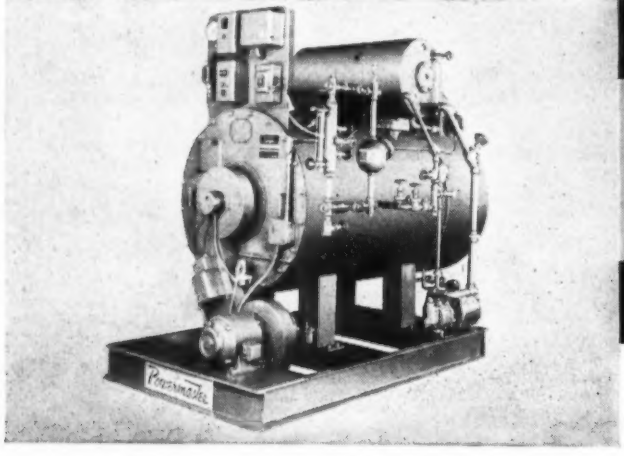
Putting in a Powermaster is quick and easy. Boiler, oil-burner, condensate return system and control panel are "packaged" in one compact unit, mounted on a structural steel base. The O&S Powermaster Steam Generator is delivered complete and—after simple service connections—ready to supply all the steam you need. No extensive preparations to make. No costly foundation to build. No smoke-belching chimney needed. Installation can be made in as few as four hours without interruption to production. Write for latest bulletin.

ORR & SEMBOWER, INC. • 960 Morgantown Rd. • Reading, Pa.


OUT!
No high, sooty stack is needed . . . a welcome contribution to community cleanliness.
IN!
Only a small, inexpensive vent is required to carry off combustion gases.

Send for Bulletin 1215

Light Oil and Heavy Oil Units—15 to 150 h.p.



ORR & SEMBOWER

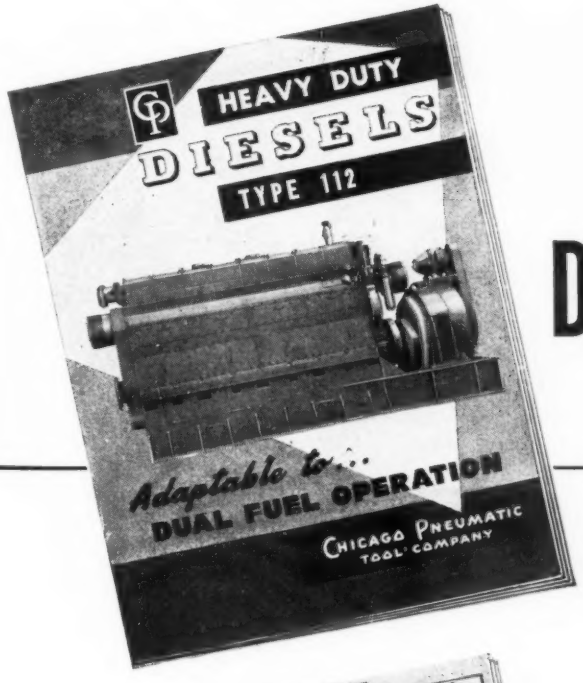
Powermaster*

STEAM GENERATORS

* REG. U. S. PAT. OFF.

For continuous, heavy-duty service

CP DIESEL
OR
DUAL FUEL ENGINES



Write for Bulletin 763 on Model 112 Diesel engines and Bulletin 761 on Dual Fuel engines, or call on your nearest CP office for detailed information.

CP Model 112 Diesel engines have proved to be thoroughly dependable, heavy-duty power units for generating plants, waterworks, and other types of service.

In their ultra modern design are incorporated such features as hydraulic governors, aluminum pistons, "Satco" precision bearings, four-valve heads, and Bendix-Scintilla pumps and nozzles.

Available with either flat or marine type base, for straight DIESEL or DUAL FUEL operation, in sizes from 320 HP to 960 HP.

Model 812-CP, 640 HP, 720 RPM Diesel Generating Unit.

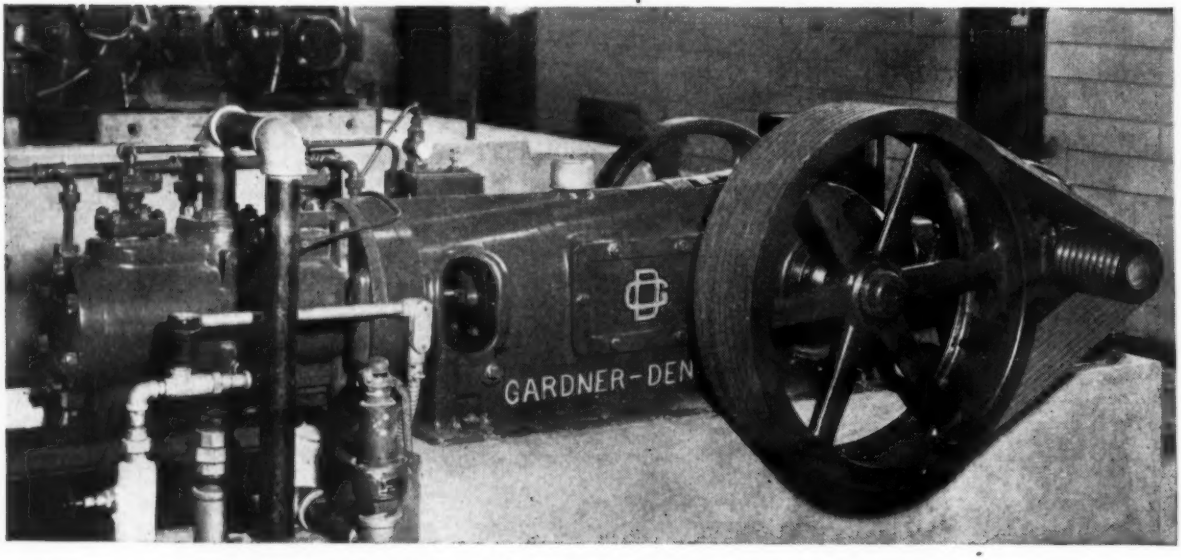
CHICAGO PNEUMATIC
TOOL COMPANY
General Offices: 6 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

where service is round the CLOCK

FOR full-load, heavy-duty, continuous service, an air compressor must be *rugged*. And that's why ruggedness is built into every part of the Gardner-Denver "RX" Compressor. From its strongly ribbed frame to its alloy iron cylinders, it is engineered to stay on the job — day after day, month after month. Here are some of its features:

- *Special cylinder design for high volumetric efficiency and low horsepower requirements*
- *Duo-plate cushioned valves—simple, durable, unusually quiet.*
- *Crankshaft supported by Timken adjustable double row tapered roller bearings.*
- *Large and unrestricted port areas help reduce heat of compression; insure effective lubrication with minimum oil consumption.*
- *Suction valve unloaders on all inlet valves result in lowest power consumption during unloaded period.*
- *Oil-tight, dust-tight construction.*



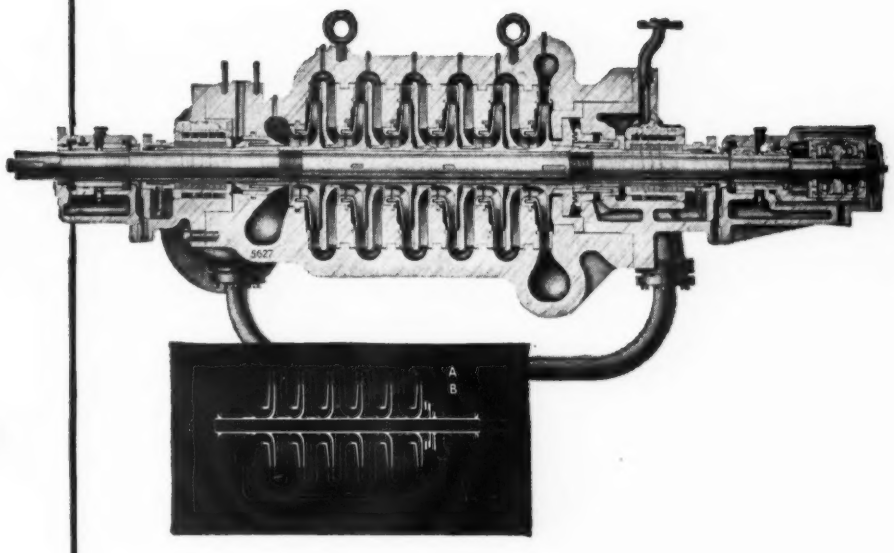
Gardner-Denver Class "RX" Single Stage Horizontal Compressor—available in capacities from 89 to 1292 cubic feet displacement per minute.

GARDNER-DENVER

SINCE 1859

For complete information, write
Gardner-Denver Company, Quincy, Illinois.

ALL THRUST ALWAYS BALANCED



The exceptionally satisfactory performance of De Laval high pressure boiler feed pumps over many years is due, in no small measure, to the De Laval Automatic Hydraulic balancing arrangement. With this hydraulic balance, all thrust is automatically brought to a state of perfect equilibrium, the functioning of the device being unaffected by wear, load or other variables.

How the thrust is balanced

Any unbalanced thrust causes the rotor to shift axially, thus regulating flow through clearance A, thereby controlling pressure against balancing disc B and thus automatically returning the pump to a state of perfect balance.

Send for Catalog B-5-A describing De Laval multistage, single suction pumps for high pressure service.

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BF-3

DE LAVAL STEAM TURBINE COMPANY • TRENTON 2, N. J.

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DODGE TIMKEN

These Two Names

ON ANTI-FRICTION BEARINGS ARE YOUR ASSURANCE OF *QUALITY, DEPENDABILITY* AND *PERFORMANCE* WHICH ENABLE YOU TO CUT COSTS AND INCREASE PRODUCTION

Dodge-Timken Double Interlock Pillow Block. Dodge mounts, seals and houses the bearing assembly, delivers the pillow block fully assembled ready to lock on the shaft and run at full speed and full load. This is one of the famous Dodge 30,000 hour line, covering a wide range of industrial bearing requirements, and promptly available from Dodge distributors' stocks.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER
your local Dodge distributor, for news of latest developments in power transmission equipment. Look for his name in your classified phone book under "Power Transmission Equipment."

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NAME PLATES — FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

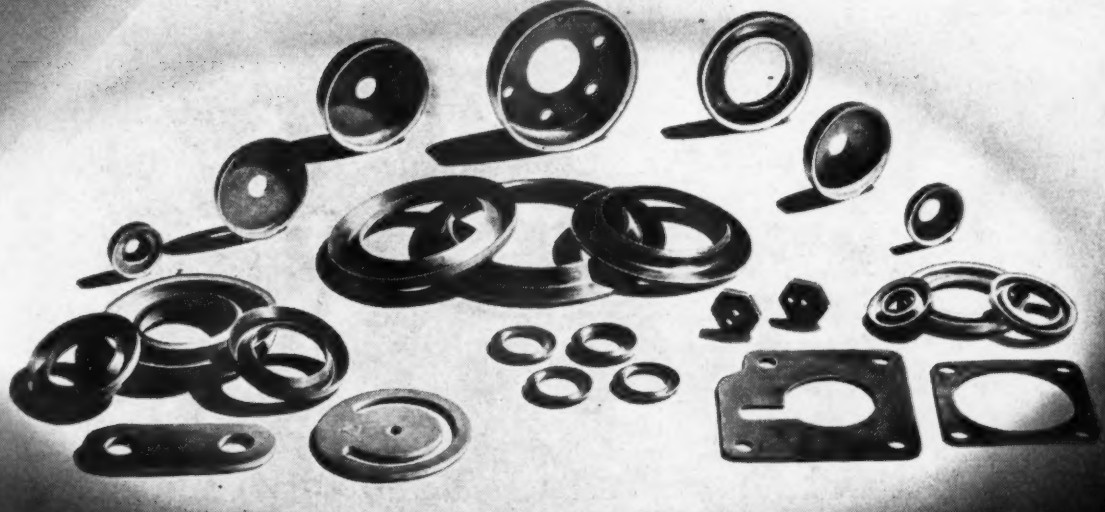
GARLOCK *Bitan*

Leather Packings

are tanned and treated by an exclusive Garlock process for severe service

GARLOCK *Bitan* packings are made from carefully selected raw leather, specially tanned and treated by an exclusive process. This gives Bitan packings high tensile strength to withstand the heaviest pressures and also makes them resistant to temperature, acid or alkaline solutions. In filling each order, the leather is properly tanned and treated for the particular service for which the finished product is to be used. All types or forms including: Molded Cups, "U" and "V" Packings, Flange or Hat Packings, Gaskets, Washers, and Discs. All sizes. Write for descriptive folder.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.



Solving AIR COMPRESSOR TROUBLES

Lubrication Engineer's Report:

"A mining company* in the Joplin area was having trouble with the unloading valve on an Angle Compound Air Compressor. They were also troubled with discharge valve breakage of the high pressure cylinder.

"The previous oil was replaced with Cities Service North Star Oil No. 5 and not a single instance of gumming or sticking or trouble of any kind with the unloading valve or discharge valve has been reported in over two years."

Case No. 1:

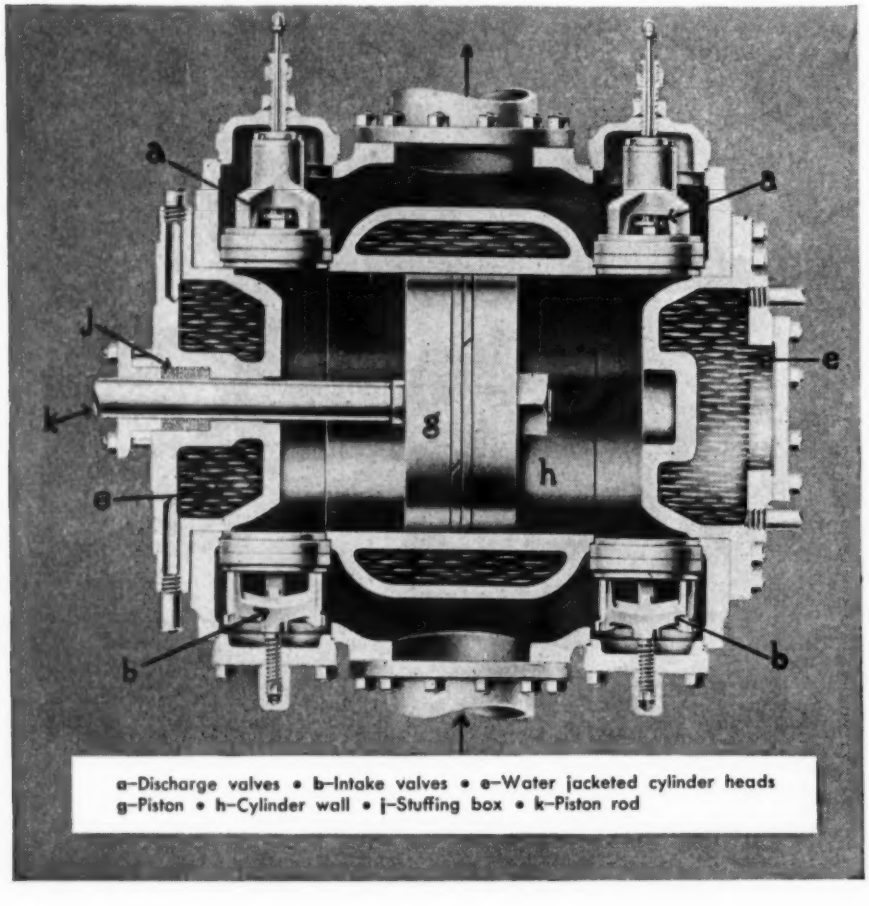
"A utility plant* in Springfield, Mo., uses compressed air from a single stage belt-driven air compressor in connection with overhauling jobs of the boilers in their plant. They are all of the water tube type and are overhauled at regular intervals. During these overhauls they need a constant supply of air. The unloading valve of this compressor would gum up to the extent that they would have to clean it about every other day when using a competitor's oil. I sent them a drum of Cities Service North Star Oil No. 5 about a year ago, and checked with their Chief Engineer last month. He tells me they haven't had to clean the unloading valve since putting in the North Star Oil."

Case No. 2:

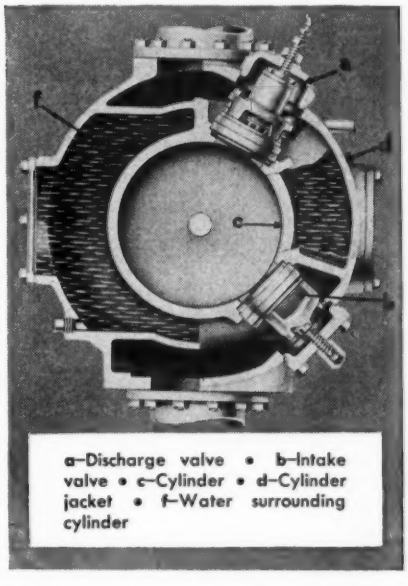
"We have lubricated a 1000 cubic foot two-stage air compressor in the Mid-Continent area for over three years. The customer* says that in using Cities Service North Star Oil No. 5 in this compressor he hasn't had any valve breakage and that carbon deposit on valves and seats has been down to practically nothing."

Case No. 3:

*Names on request.



a–Discharge valves • b–Intake valves • e–Water jacketed cylinder heads g–Piston • h–Cylinder wall • j–Stuffing box • k–Piston rod



a–Discharge valve • b–Intake valve • c–Cylinder • d–Cylinder jacket • f–Water surrounding cylinder

Solving compressor operating problems has been Cities Service's special forte for years. A phone call or card to the Cities Service office nearest you will bring this engineering experience to *your* plant. There is no obligation. For useful information that every air compressor owner and operator should know, write for our free booklet, "Air Compressor Lubrication." Cities Service Oil Co., Sixty Wall Tower, New York 5, N. Y., Room 87.

Free Booklet:

Cities Service means Great Service

CITIES SERVICE

Cities Service Oil Co.
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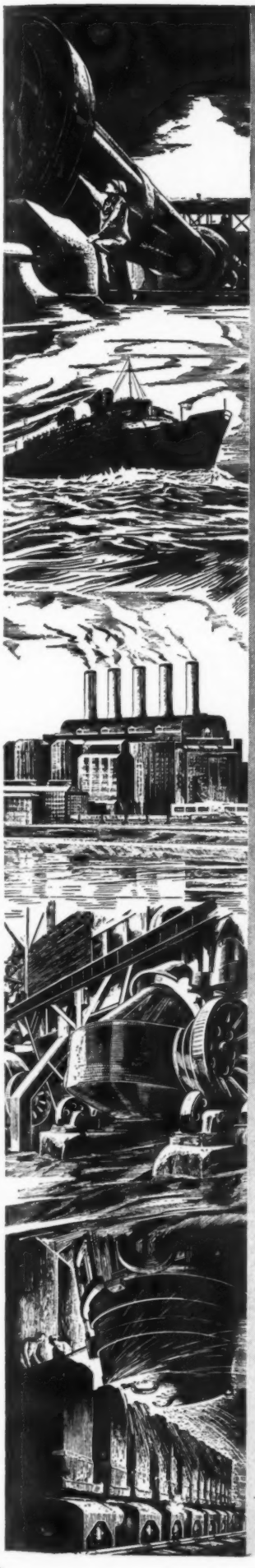
SHREVEPORT, LA.



COMPLETE REFRACTORY SERVICE

From Drawing Board to Finished Job

BEFORE the wheels of industry can turn, refractory requirements must be determined. In these times of peak production while striving to fulfill post-war wants, the time element is a major consideration. The first question is, "When can we get it?"

The A. P. Green Fire Brick Company in keeping with the trend of the times, has a distribution system which overcomes the important problem of time loss in getting the refractory information and materials that you need.

Distributor warehouse stocks of a complete line of quality refractory materials are located throughout the country—you can be sure that the refractories you need are close to your plant.

A. P. Green distributors are carefully trained and have had wide experience in handling refractory jobs—installing A. P. Green's specialty products in complete settings or small repairs. They can furnish the materials and give technical assistance on any type or size of job. The entire engineering staff of the A. P. Green Company is available for advice on your particular problem.

With this "service" system, every step—from prompt delivery to finished installation—is covered.

Look for your A. P. Green distributor in the classified section of the telephone directory or write us for his address.

COMPLETE WAREHOUSE STOCKS NEAR YOUR PLANT

PROMPT, COURTEOUS DELIVERY TO YOUR JOB SITE

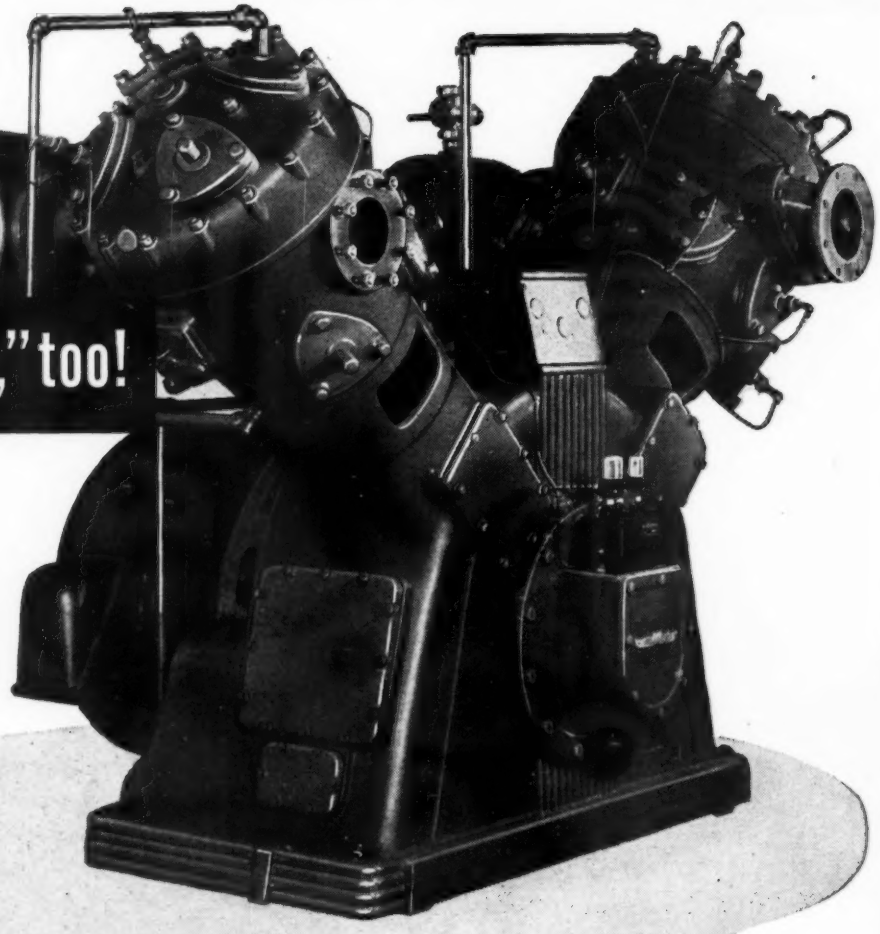
EXPERIENCED ENGINEERS TO ADVISE ON YOUR PROBLEMS

A. P. GREEN FIRE BRICK CO.
MEXICO, MISSOURI, U. S. A.

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

A. P. Green REFRACTORY PRODUCTS

It's a "Cost-Compressor," too!



The Worthington YC Saves You Money In Every Detail of Installation and Operation

Installation Savings

- Takes ½ the building space and ¼ the foundation space of same capacity horizontals.
- Comes assembled; needs no alignment, special clamps or erecting engineer.
- Needs only power and air connections to put it to work.
- Quickly and easily installed, even where subsoil is poor.
- Lighter weight reduces transportation charges.

Operation Savings

- Perfectly balanced Y-frame for higher rpm cuts motor costs.
- Specially designed bearings and rods eliminate ordinary wedge-adjustments.
- Outside valves, large openings, easy-to-reach parts allow quick inspection.
- Spare parts smaller and less expensive.
- Worthington Feather* Valves are the lightest, most efficient, most economical ever made.

Another big advantage of YC's is their adaptability to many drives — Multi-V-Drive, coupled drive from explosion-proof motor, steam turbine, or practically any type of rotative power. Still another is the instantly responsive, power-saving, 3- and 5-step *variable capacity control* . . . From start to finish you'll pay less for air with these rugged, long-lived, cooler and smoother running Worthington YC Compressors.

Write for Literature

Bulletin L-667-B1A will give you the whole story . . . and further proof that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

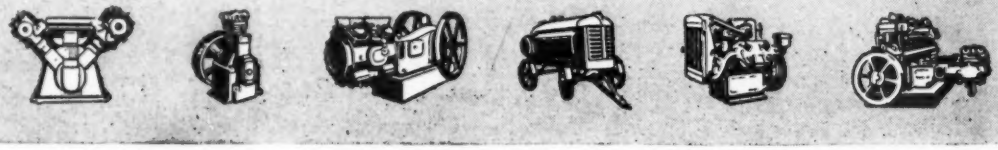
WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

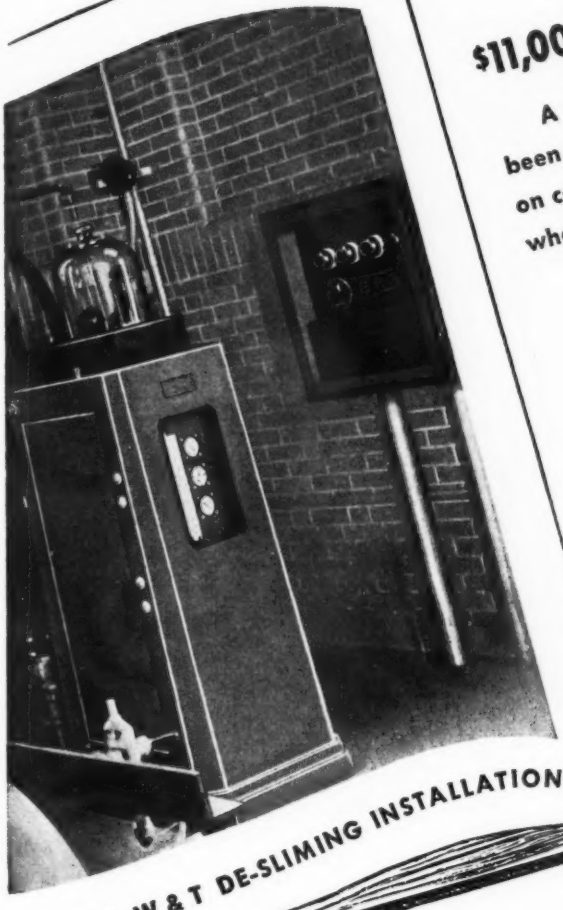
*Reg. U. S. Pat. Off.

K7-2

Y-Types | Vertical | Horizontal | Portable | Radial | Gas-Engine Compressors



SHORT, SHORT Profit STORY



TYPICAL W & T DE-SLIMING INSTALLATION

$11,000 a year from cooling water

A progressive midwestern power company has been using the W & T intermittent De-Sliming Process on condenser cooling water for over ten years. Here's what they report for a typical year:

Fuel saving	$9900.00
Labor saving	4000.00
Gross saving	$13900.00
Operating and depreciation cost	$2900.00
NET SAVING	$11000.00

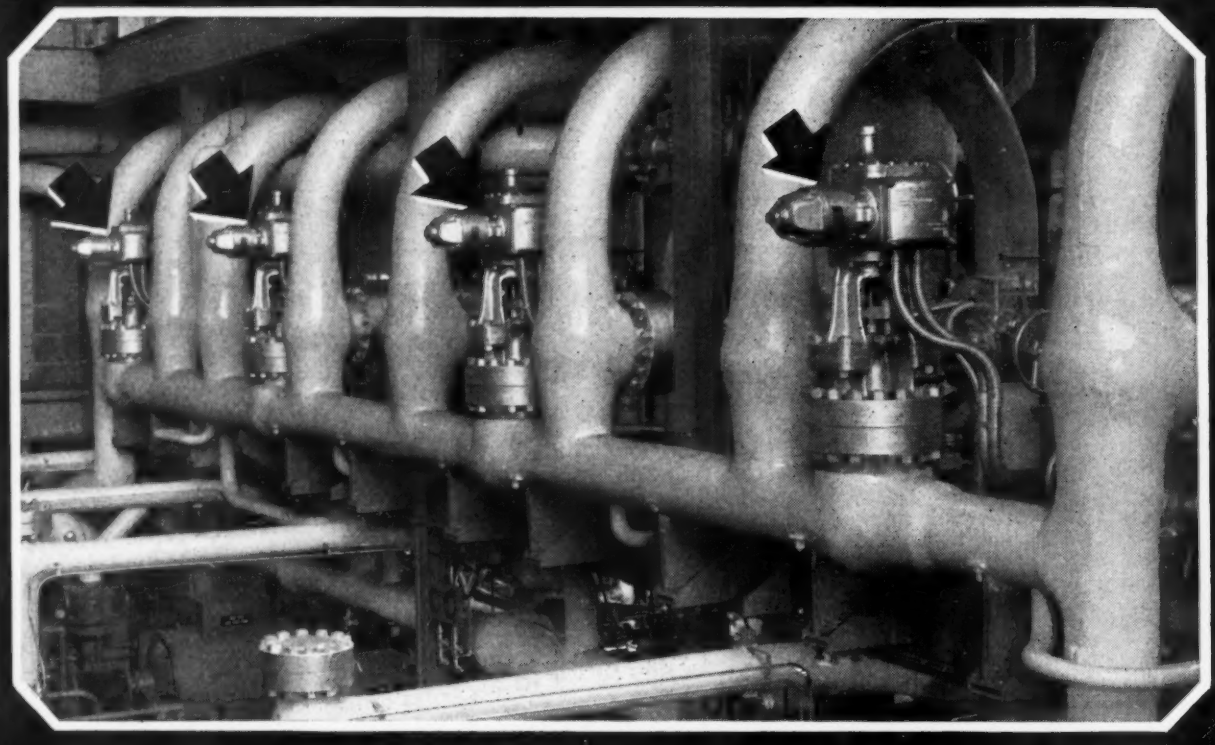
In addition, they have eliminated the disagreeable job of plug cleaning, have all units always available at maximum capacity and make more efficient use of existing cooling water supplies without additional expense.

W & T Field Engineers will be glad to discuss the application of chlorination through the Intermittent De-Sliming Process to your condensers and heat exchange equipment. Call on them freely or write for technical information today.

CD-25

WALLACE & TIERNAN
PRODUCTS, INC.
BELLEVILLE 9 NEW JERSEY

HUNDREDS upon HUNDREDS
of *Limitorques* are in daily, dependable use—



—in Central Stations, Industrial Power Plants Oil Refineries and Process Industries in America

Limitorque Automatic Valve Operators are the modern, quick, safe and economical way to open and close plug, cock, globe and gate valves . . . *by local and remote control.* They are widely used on Steam, Water, Gas, Air, Oil and Process Liquid Lines,—and are being installed in ever-increasing numbers. . . . Just a *"push of the button"* sets them in operation.

Limitorques are "self-contained", and weather, dust and fume-proof. They are readily bolted-on to the valve yoke, and need no extra gears, nuts or bearings. In addition, they are *absolutely safe,* because the Torque Seating Switch insures tight valve closure, without strain on disc, seating rings or valve stem. . . . Protection from damage due to "foreign objects" is positively prevented, because the motor is shut-off by thrust exerted on the valve disc.

Send for latest literature,—and please use your Business Letterhead when writing for same.

Philadelphia
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NEW YORK • PITTSBURGH • CHICAGO . . . IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

R/M RUBBER SHEET PACKINGS

R/M makes a complete line of rubber sheet packings, designed to meet operating conditions in chemical and oil processing plants where high temperatures prevail, as well as general purpose rubber sheet packings for cold-water service at low pressures.

R/M Red Rubber Sheet Packing, Style No. 625, is one of the most popular sheets. It is made of long-lasting, tough red compound that conforms to rough surfaces. Recommended for air, cold or hot water, and steam up to 150 pounds.

Resilient Flexlastic Sheets for cold water, low pressures, general service and for pipeline gaskets are supplied in three different styles . . . "C. I." Sheet, Style No. 635, with one ply of cloth for each 1/16" of thickness . . . "C.O.S." Sheet, Style No. 638, same as Style No. 635 but reinforced with an additional ply of fabric on one side . . . and "C.B.S." Sheet, Style No. 641, same as Style No. 635 but reinforced on both surfaces.

R/M Diaphragm Sheet, Style No. 645, for damper regulators, is a high-tensile, square-woven duck covered with Flexlastic, compounded to resist air, water, steam and oil.

These specialized sheet packings are typical of the many packings of all types which your authorized R/M distributor can supply to meet the packing needs in your plant. Call him today for reliable packing service.

Style No. 625

Style No. 635

Style No. 645

RAYBESTOS R M MANHATTAN

R M

RAYBESTOS-MANHATTAN, INC.

ASBESTOS TEXTILE & PACKING DIVISION

MANHEIM, PA. • BRIDGEPORT, CONN. • NORTH CHARLESTON, S. C. • PASSAIC, N. J.

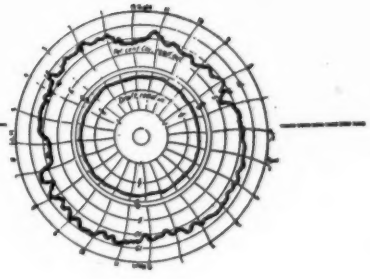
IT'S "PACKED WITH SATISFACTION" WHEN YOU USE R/M

UNIFORM COAL SIZING REDUCES...

RAGGED FIRING

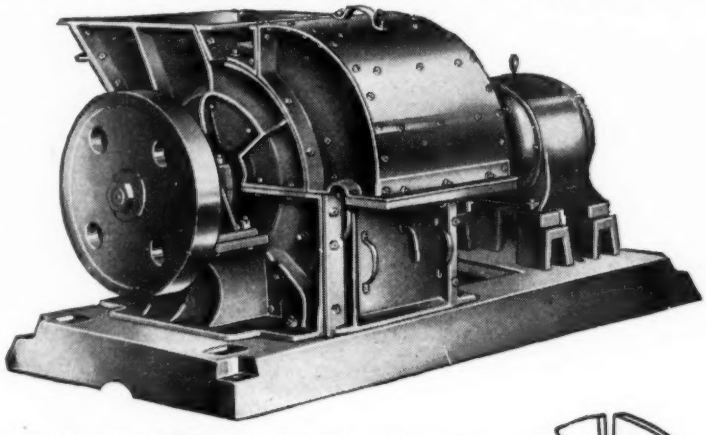
EXCESSIVE CO_2

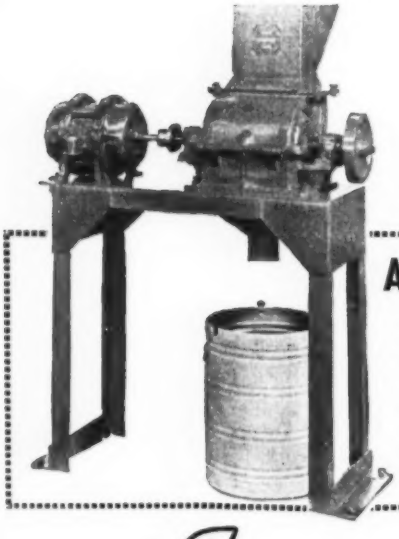
ASHPIT LOSS



AMERICAN Rolling Ring CRUSHERS give High Tonnage and Uniform Sizing with Minimum Fines and No Oversize

Ragged firing—with alternately excess air and insufficient air . . . excessive CO_2 instead of uniform combustion . . . excess ash pit drops—are all costly and inefficient results of coal not uniformly sized. ROM coal, even poor grades, is uniformly reduced by Americans for improved firing efficiency. Control of fines and no oversize provide for uniform, high combustion.





American Type "S" Crusher with housing of massive, high test cast construction—rib reinforced to withstand enormous crushing strains. Dust-tight machined joints. Self-aligning anti-friction bearings in dust-tight pillow blocks.

AMERICAN Laboratory Mills

AMERICAN Laboratory Mills are custom-built to provide the required action for your specific laboratory or pilot plant operation. Rolling rings, shredder rings or hammers of regular or special types can be furnished to provide the exact type of reduction needed. In addition, AMERICAN Laboratory Mills reduce grog for use in firepot replacement.

The basis of greater crushing efficiency is the manganese shredder rings — exclusive with Americans. Because shredder rings split coal at low, power saving speeds instead of crushing it at high speeds—fines are controlled. Each ring revolves on an individual shaft—free to deflect without damage from tramp iron—eliminating the necessity for shear pins or conventional safety devices.

Send for bulletin: "Crushing Coal for Less Than 1¢ a Ton"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
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Want to minimize SLUDGE FORMATION?

CENTRIFUGE THE OIL WITH A *De Laval!*

WATER in turbine oil is a prime source of sludge formation. Since it is impossible to prevent a certain amount of water from getting ***into*** a turbine lubrication system, it is important to remove this water if sludge formation is to be minimized.

De Laval Oil Purifiers remove water from oil by means of centrifugal force, discharging the water continuously. If a sudden water leak should occur, the possibility of even more serious trouble is likewise minimized because the De Laval unit properly selected for size has ample reserve capacity to remove sudden "slugs" of water.

At the same time a De Laval Oil Purifier removes ***dirt*** from the oil, storing it out of harm's way until it is convenient to clean the bowl. Because of the design of the De Laval bowl, there is no possibility of either water or dirt recontaminating the oil that has been purified.

In short, a De Laval provides maximum protection against ***both*** troublemakers — water ***and*** dirt. Write for your copy of Bulletin TO-1.

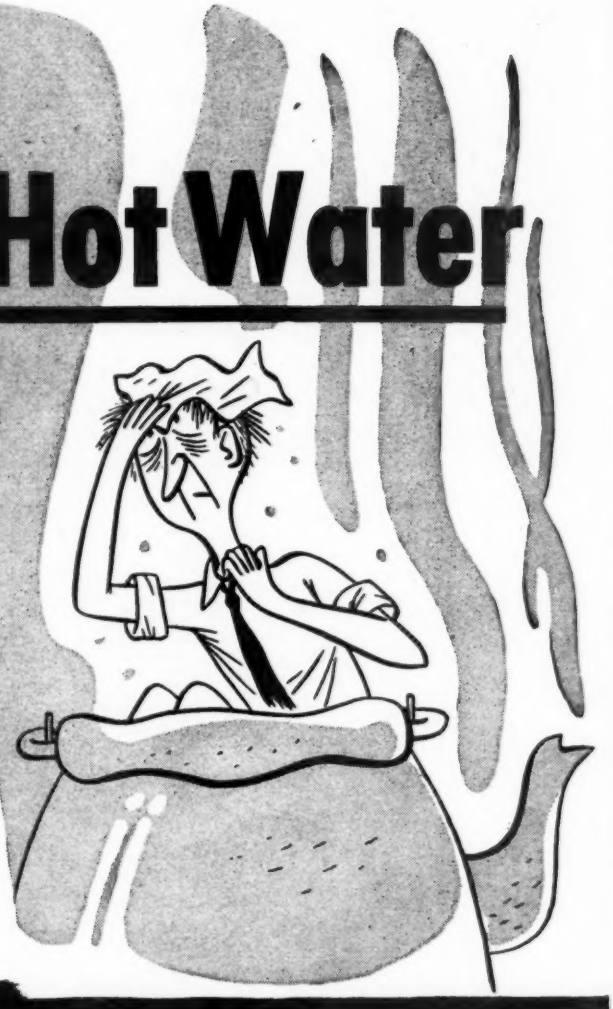
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
PETERBOROUGH
QUEBEC MONTREAL WINNIPEG VANCOUVER

DE LAVAL
OIL PURIFIERS

FOR MORE *Dependable* POWER PRODUCTION

If You're in Hot Water

Over Hot Circuits



SWITCH TO ROCKBESTOS A.V.C.

When you're on the carpet because of repeated wire failures that skyrocket maintenance expense—you need ROCKBESTOS A.V.C.

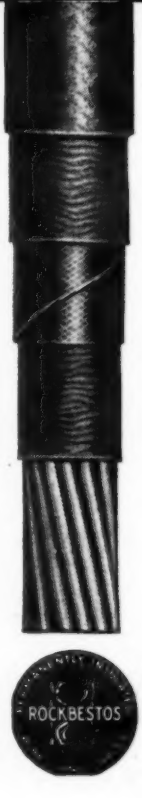
Here's why: Rockbestos wires and cables are *permanently* insulated with impregnated asbestos that resists extreme heat and corrosive fumes. They won't bake brittle, crack or flow—even at torture temperatures up to 230° F. They won't burn or support flame. They withstand repeated exposure to oil and grease without rotting. They also resist aging and oxidation because asbestos doesn't deteriorate.

One or more of 125 standard Rockbestos constructions in 300 to 5000 volt ratings can do a real cost-saving, high-performance job for you—single and multi-conductor power cables, switchboard and lighting wires, control cables and other N. E. code types. Write for catalog, recommendations or samples.

ROCKBESTOS PRODUCTS CORPORATION
189 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation



QUICK Facts About LONGER Cable Service

Type AVA, Rockbestos A.V.C. 600 Volt Power Cable illustrated (No. 18 AWG to 2,000 MCM) and similarly insulated Motor Lead Cable have a maximum operating temperature of 230° F., and this failure-preventing construction:

Age-resistant impregnated asbestos braid that resists heat, flame, moisture, oil, grease and corrosive fumes.

Outer wall of felted asbestos insulation, impregnated with heat, flame and moisture resisting compounds, won't dry out, crack, flow, rot or burn.

Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.

Inner wall of impregnated felted asbestos withstands conductor-heating overloads — won't break brittle or burn and helps provide greater current carrying capacity.

Conductor is perfectly and permanently centered in helically applied non-flowing insulation.

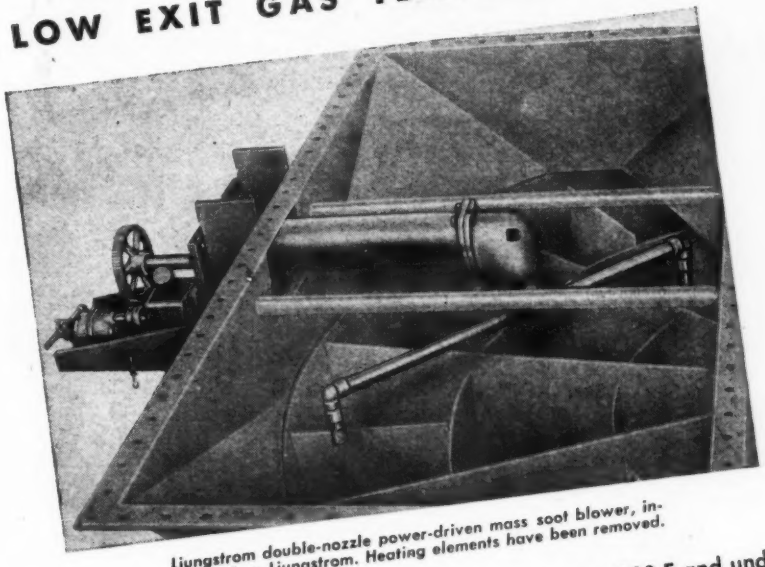
One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions.

NEW YORK BUFFALO CLEVELAND DETROIT CHICAGO ST. LOUIS LOS ANGELES PITTSBURGH SAN FRANCISCO SEATTLE PORTLAND, ORE.

ENGINEERING PROGRESS REPORT #13

LJUNGSTROM AIR PREHEATER

HIGH SULPHUR FUELS AND LOW EXIT GAS TEMPERATURES

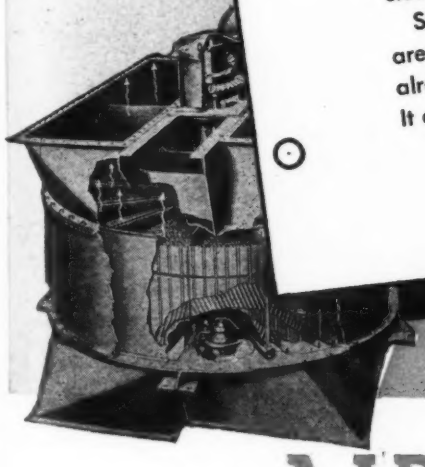


Ljungstrom double-nozzle power-driven mass soot blower, installed in a Ljungstrom. Heating elements have been removed.

If you are operating with a low exit gas temperature, (300 F and under) and are burning high sulphur fuels, (2 to 4 per cent sulphur) deposits are formed on the low temperature end of the heat-exchange surface.

With the Ljungstrom Air Preheater, a special mass soot blower, either single or double nozzle, can apply a high-velocity jet of steam or air at the cold end, with the nozzle only inches away from all the deposits. This removes them and reduces the rate of corrosion. The unit may be cleaned while in full operation.

Standard equipment on all new Ljungstroms, the mass soot blowers are currently available at nominal cost for application to Ljungstroms already in operation. Installation of the mass soot blower is simple. It can be added to most Ljungstroms over the week-end shut down.



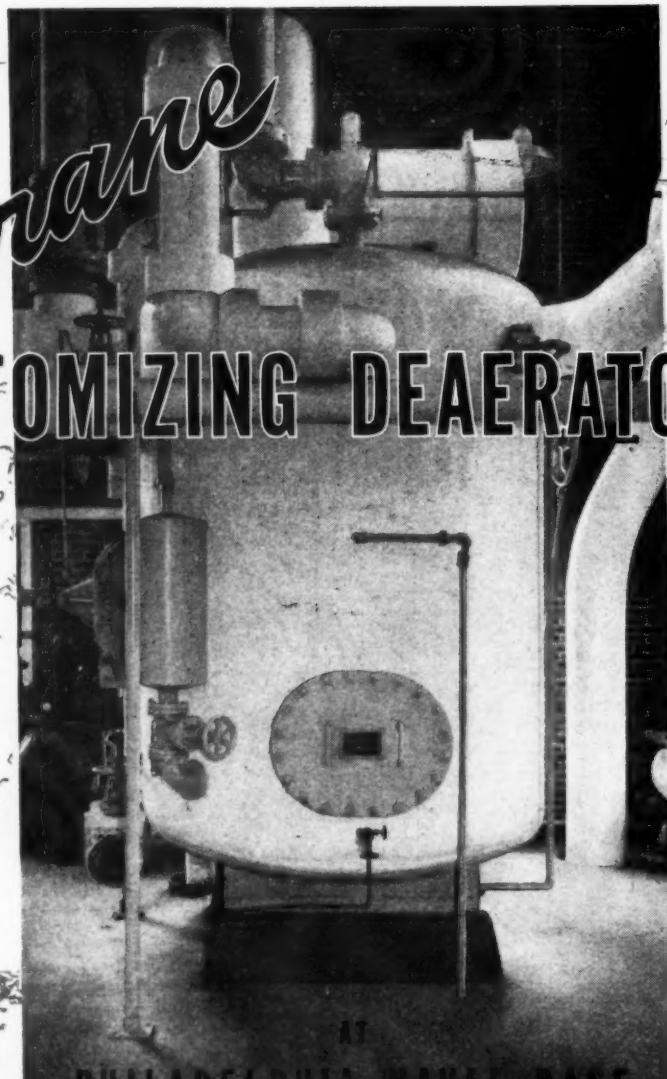
THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

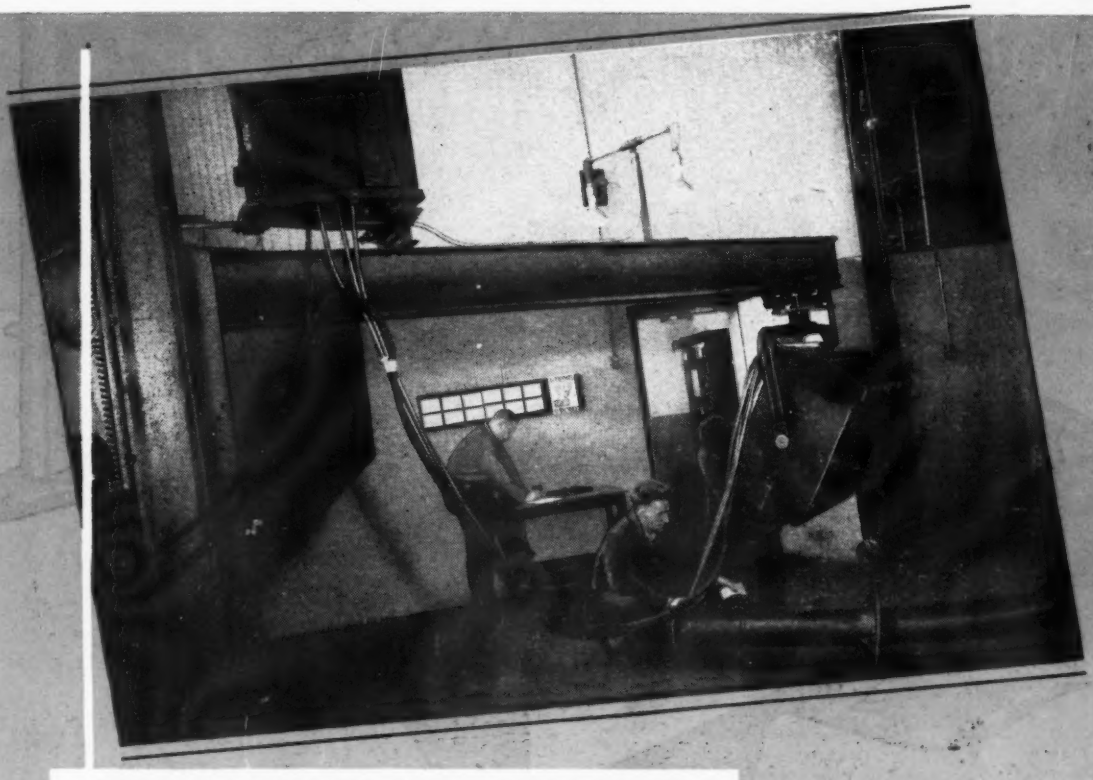
Cochrane ATOMIZING DEAERATOR



At the huge Naval Air Material Center, Philadelphia Naval Base, recent extensions to the boiler plant included a Cochrane Atomizing Deaerator of 260,000 lb/hr capacity operating under a guarantee of "zero oxygen" removal. It is especially fitting to find a Cochrane Atomizing Deaerator in a Navy boiler plant, even in a shore installation, for it was for marine use in particular that Cochrane invented the Atomizing Deaerator. While it has special advantages for stationary power plants, its great value on shipboard is its freedom from trays, permitting complete deaeration, regardless of list, pitch or roll. Light weight and compact design are other Cochrane features.

COCHRANE CORPORATION • 17th Street & Allegheny Avenue • PHILADELPHIA 32, PA.

MODERN PRESSURE PIPING REQUIRES SPECIALIZED SHOP FACILITIES AND PERSONNEL



METALLURGICAL CONTROL

Exercised by the Qualified Pipe Fabricator

ASSURES BETTER PIPING

No piping system can be better than the parent metal and the metal deposited by the welder. The physical and chemical characteristics of pipe materials and weld metal are of especial importance in modern pressure piping.

To be certain of highest quality and the absence of defects, qualified pipe fabricators maintain well equipped metallurgical laboratories staffed by carefully trained specialists.

X-ray equipment — microscopes — photomicroscopes—gamma ray equipment—chemical laboratories—magnaflux equipment—are some of the means used in checking internal and external physical structure and chemical analysis.

Metallurgical investigation and tests are a part of the elaborate program instituted by qualified fabricators for the purpose of providing you with better piping.

Pre-fabricated piping is superior piping. Its quality is maintained to highest standard by careful controls throughout fabrication.

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1109 CLARK BUILDING PITTSBURGH, PA.

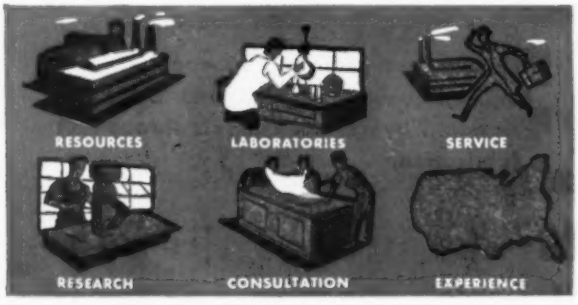
Write for Technical Bulletin describing pressure piping fabrication

3029-3

Worth looking into

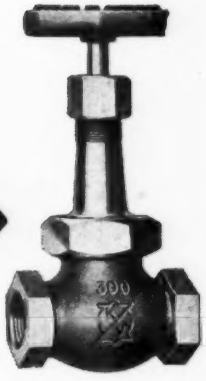
RESOURCES — *Pictured above is the modernly equipped Drew plant, where Ameroid water treatments are produced. Vast resources and the highest standards assure users of Ameroid Complete Boiler Water Treatment of quality products.*

When you look into the AMEROID system you'll find it backed by all the factors necessary for a completely successful boiler water treatment . . . a national service organization of trained chemists and engineers; modern analytical laboratories; controlled manufacturing facilities; a progressive research program; and the "know how" that comes only from wide experience. An AMEROID representative will be happy to discuss boiler water conditioning with you at your convenience.

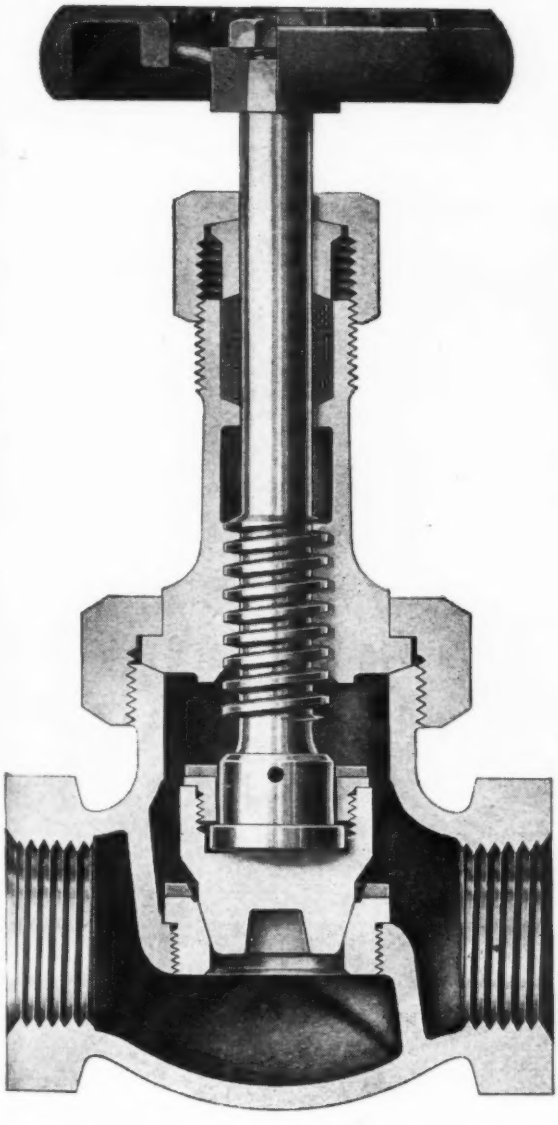


E. F. DREW & CO., INC.
15 EAST 26th STREET, NEW YORK 10, N. Y.
COMPLETE AMEROID SERVICE is available in key cities of the United States, Canada, Mexico, Brazil and Puerto Rico.

when you see this



on the outside



Kennedy Bronze Globe Valves are available in a wide variety of types, with screwed or union bonnet, with bronze disc, renewable composition disc, regrinding, plug-type or full-way disc. Pressures up to 300-lb. steam, 600-lb. water, gas or oil. Illustration shows 300-lb. valve with plug-type disc and renewable seat ring.

you can count on wear resistance on the inside

Looking for extra wear resistance? You will find it in a Kennedy Valve. For instance, this plug-type bronze globe valve has renewable nickel-copper alloy disc and seat rings with extra wide seating surfaces. They offer real resistance to the destructive action of foreign particles and wire drawing.

Look at the illustration and you'll see many more typical Kennedy features that assure year-in, year-out service satisfaction. Full details of all Kennedy bronze and iron-body gate, globe, angle and check valves, pipe fittings, flanges, and other valves and accessories are shown in the 240-page Kennedy Catalog. Write for your copy today.

• **BUY FROM YOUR LOCAL DISTRIBUTOR**

KENNEDY

valves-pipe fittings-fire hydrants

KV-147

THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK *Offices and Warehouses in Principal Cities*

Operating Cost Savings

ENGINEERED INTO PIPING BY NAVCO

Careful and expert preliminary engineering work by Navco Engineers, in addition to employing the most modern fabricating and erection methods, are your guarantee of operating savings.

Consult Navco for just a Pipe Bend, or a complete Piping System.

- ★ Assured Safety
- ★ Efficient Operation
- ★ Minimum Fuel Costs
- ★ Low Maintenance
- ★ Long Trouble-Free Life

NAVCO

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • TULSA • BUFFALO • CINCINNATI

FOR *Fuel Economy* BUY SUPERIOR DIESEL ENGINES

Superior's nearly 60 years of engine building experience has resulted in a Diesel of modern scientific design. No feature has ever been included in a Superior Diesel until it was completely tested and proved. That's why, to maintain these high standards, Superior is engaged in a $1,500,000 plant modernization program. It's the reason too, Superior Diesel Engines are of long established 4 cycle design. Experience and wide usage have shown that this principle assures low fuel consumption and lubricating oil economy.

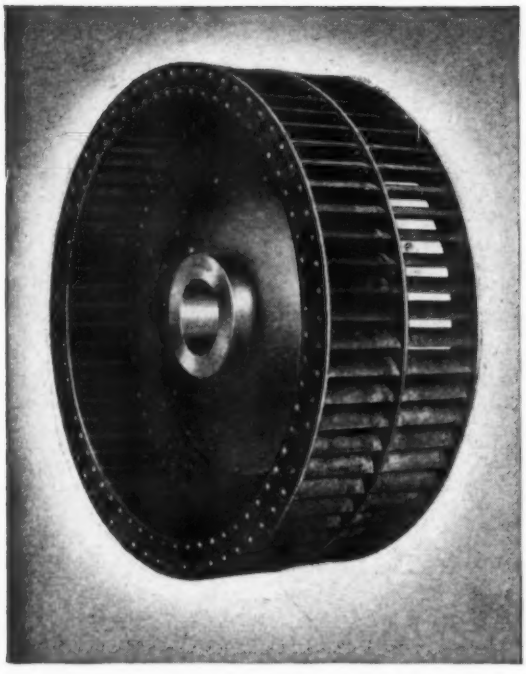
Superior Diesel Engines operate on a wide range of Diesel fuels with clean combustion and high efficiency. For proof of real fuel economy note the clear exhaust of a Superior Diesel . . . a sure sign that fuel is being efficiently burned and converted to economical power.

Eight years ago these three Superior Diesels went to work providing low cost power for a Southern Municipality. After five years of operation, the plant had completely paid for itself. In 1946, two Superior Model 80 Supercharged Diesel Engines were installed to meet the demand for service expansion.

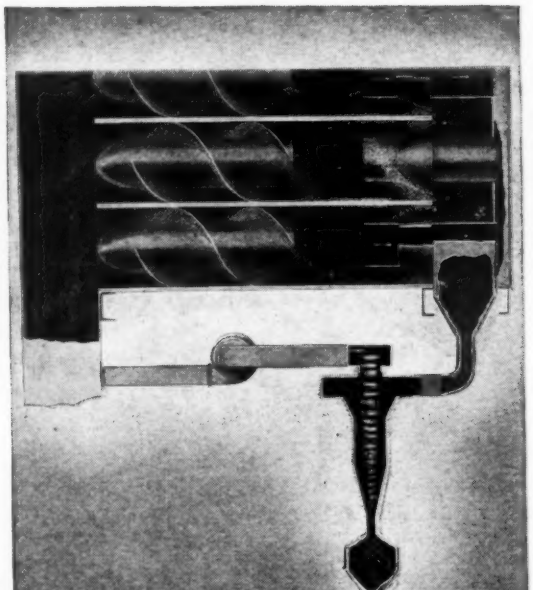
Superior DIESEL

SUPERIOR ENGINES DIVISION OF THE NATIONAL SUPPLY CO., PLANT AND GENERAL SALES OFFICE: SPRINGFIELD, OHIO

Three essential items for your Power Plant



1 American Blower Forced and Induced Draft Fans are widely known for outstanding performing qualities and dependable operation.

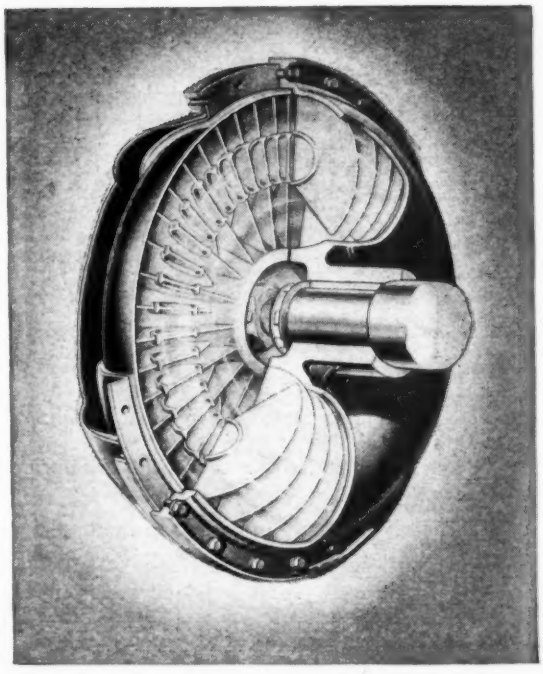


2 American Blower Type ST Dust Precipitator does away with the fly ash nuisance. A unit to take care of all steam loads. No water required—no complicated electrical equipment to clean.

American Blower Mechanical Draft Fans have been used by power plants for many years. Many of these same plants also use our Fly Ash Precipitators—and more and more are taking advantage of Gyrol Fluid Drives to provide stepless adjustable speed control on mechanical draft fans.

An additional, but equally important, use we believe you should consider in planning your new plant is Gyrol Fluid Drives for boiler feed pumps. On feed pumps Fluid Drive offers substantial savings in power and a quick easy control capable of fine increments of speed adjustment. Pressure is reduced and pump life prolonged.

Let us present the complete story of our services to power plants at your convenience. Just write, or phone, the nearest American Blower Branch Office.

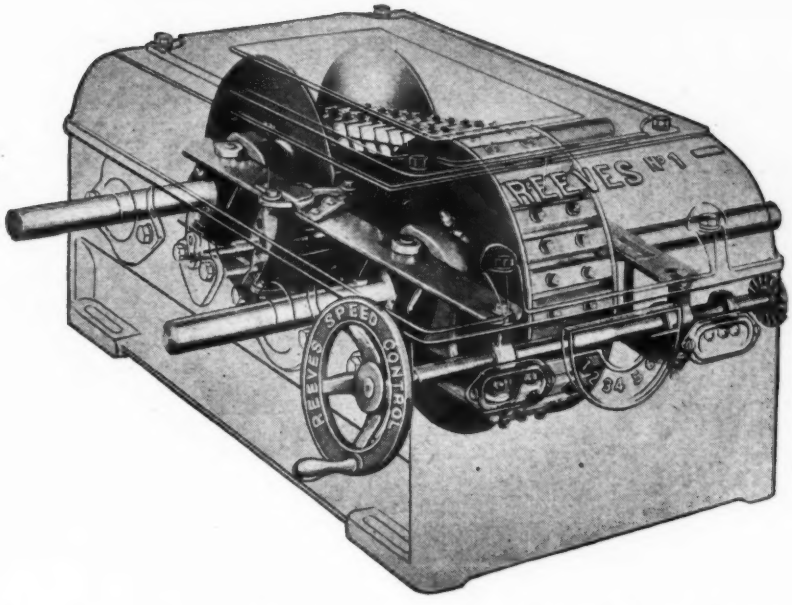


3 Gyrol Fluid Drive has proved so successful for adjustable speed fan control, we needn't go into details. It's great for boiler feed pumps, too.

AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



Industry's Approved Method of Accurate, Variable Speed Control

The "missionary" work for variable speed control has been done. On every hand, in every industry where operating conditions are subject to change, there is abundant evidence to support its claims for increased output, improved, uniform quality and reduced cost.

Your problem, then, is one of selection . . . of determining which type and make of variable speed drive is best for your particular need. In making that choice, consider these facts about infinite, stepless REEVES Speed Control:

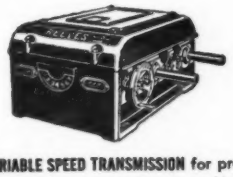
Manufactured by a company with more than fifty years' specialized experience in this specialized field. Design based on a proved operating principle. Ruggedly constructed for trouble-free operation and easy maintenance without special training or tools. Offered in a complete range of sizes, capacities and speed ratios, and furnished with any type of control . . . easily incorporated in new machine designs or applied to existing machines. Performance-proved in 260,000 installations and provided as standard equipment in 2,100 different makes of machines. Backed by a nation-wide engineering and service organization.

Think it over . . . this broad background of experience, this documented evidence of efficiency on any and all jobs . . . and we believe you will understand why REEVES is Industry's approved—*and proved*—method of variable speed control.

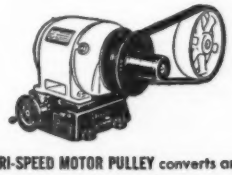
REEVES PULLEY COMPANY · COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

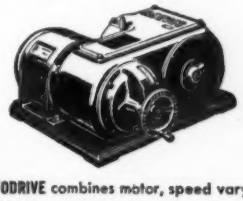
THE THREE BASIC REEVES SPEED CONTROL UNITS



VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

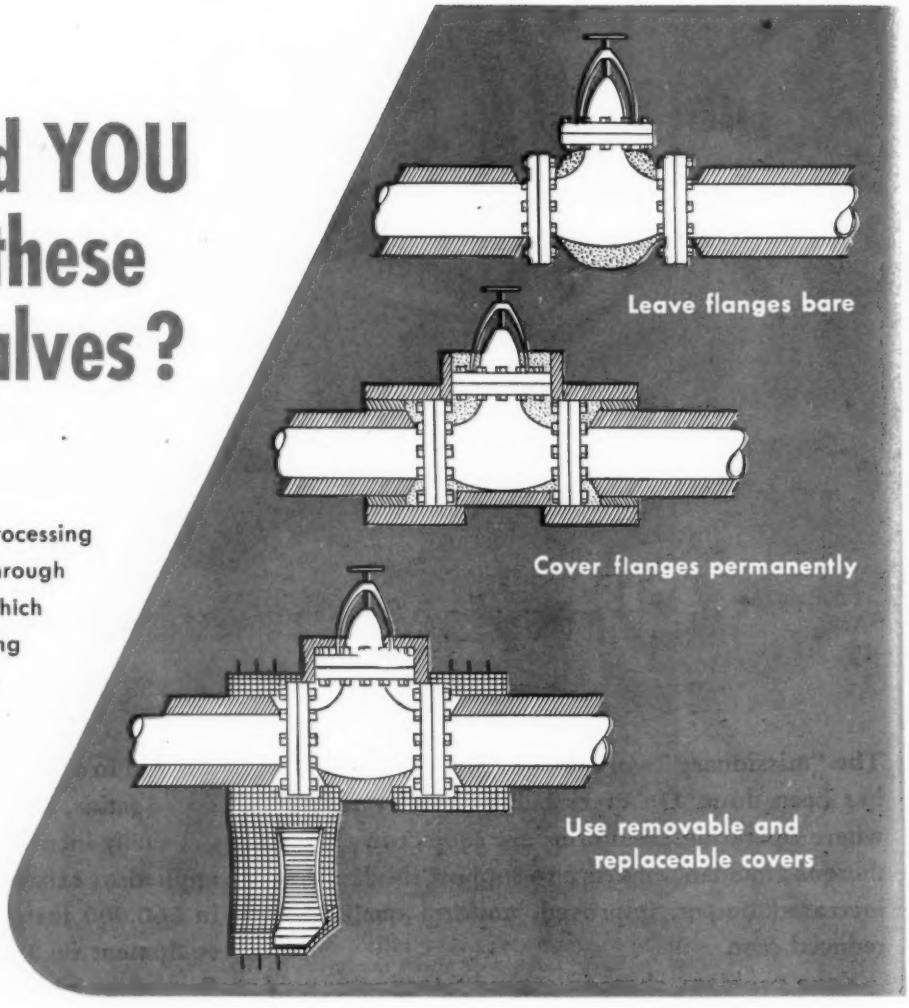
Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

How would YOU insulate these flanged valves?

High-pressure steam used for processing in a chemical plant passes through a number of flanged valves. Which of these methods of insulating the flanges will prove most economical?



Here's what the Armstrong engineer recommended

Two things govern the choice of treatment to be used on these flanges: (1) cost of steam (2) need for access to the flanges.

If the valves are likely to need frequent reseating or renewal of packing, and the cost of fuel is low, it is probably preferable to leave the flanges bare. On the other hand, where the valves are not apt to need much attention, and where fuel is expensive, the permanent insulation job is most economical. Finally, if the valves must be readily accessible, and if fuel costs are high, the use of removable and replaceable flange covers is recommended. These removable flange covers are somewhat expensive, due to the extra labor needed to mold them around hardware cloth to fit each flange exactly. But they save money in the end because they can quickly be taken off and put on by regular personnel, with a minimum of downtime.

★ ★ ★

In facing this problem, or any insulation problem, the Armstrong engineer first learns the important facts about your particular situation. Then he can draw on all his training and wide experience to offer the most satisfactory insulation methods and materials to meet your special requirements.

When you work with Armstrong's Contract Service, the insulation is actually tailored to fit your needs —all the way from the engineer's drawing board, through the procurement of materials, to the workmanship and supervision on the job. The entire Armstrong organization takes responsibility.

Free Insulation Chart

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write for your copy to Armstrong Cork Company, Industrial Insulation Dept., 7005 Maple Avenue, Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATION

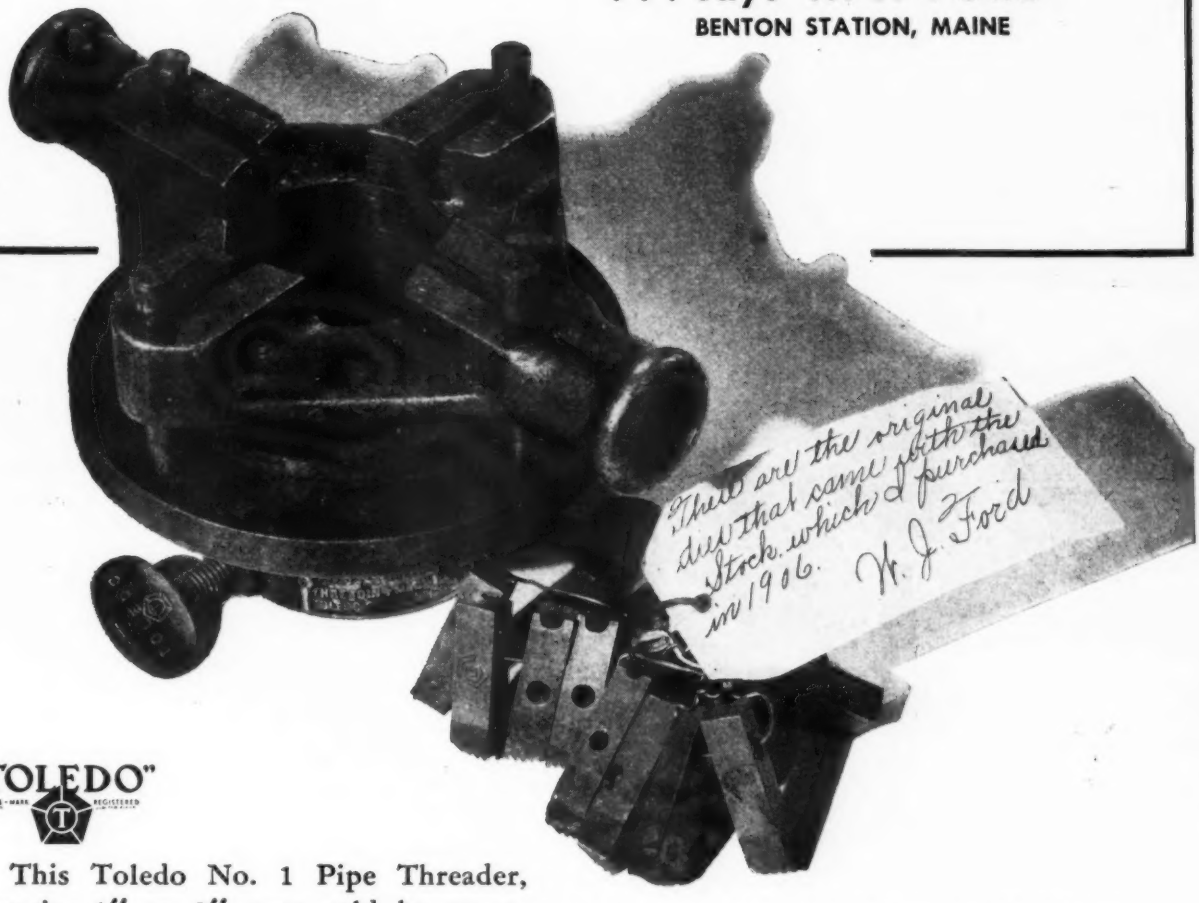
Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

"This Toledo Threader in constant use SINCE 1906"

. . . says W. J. FORD
BENTON STATION, MAINE



"TOLEDO"

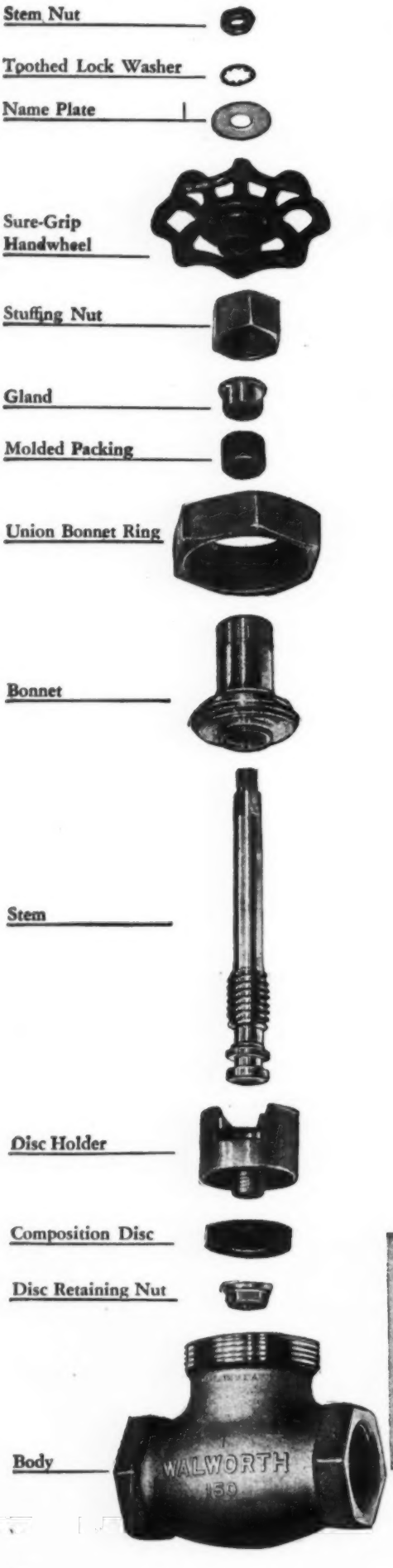
This Toledo No. 1 Pipe Threader, capacity 1″ to 2″, was sold by us on October 14, 1905, to a Boston distributor and purchased by W. J. Ford in 1906.

Mr. Ford says, "This stock was purchased in 1906 and has been in constant use ever since, but I cannot recall how many new sets of dies I have had to have in that time. *It has threaded pipe enough to reach three times around the world* and I am on the fourth lap now. When that is completed, I am going to retire and will ship the stock to you if you would like to have it to put on exhibition."

★ ★ ★

Today—the same basic principles of advanced design and quality construction keep Toledo Threaders the *preferred* tools of experienced mechanics everywhere! Get set with Toledo Threaders on *every* job—do it *better, faster* and *easier!* The Toledo Pipe Threading Machine Co., Toledo, O. New York Office, No. 2 Rector St. Bldg.

TOLEDO
PRECISION PIPE TOOLS



TO MAKE A GOOD VALVE BETTER

Walworth has redesigned and improved its No. 95 Quality Bronze Globe Valve.

150 pounds working steam pressure at 500F

300 pounds cold water, oil, or gas.

Can be repacked under pressure when fully opened.

The Walworth No. 95 Bronze Globe Valve has always been tops with piping men because they liked these features: Renewable composition disc; lock-on, slip-off disc holder; union bonnet construction; deep stuffing box; tough bronze body made of Composition M (ASTM B61).

Now Walworth has added these improvements: (1) New cylindrical disc holder that accurately guides the disc to the seat, regardless of the position in which you install the valve. (2) Newly designed, air-cooled, sure-grip handwheel that you can grab and turn, even when wearing greasy work gloves. It has a tapered square hole sized to gage to fit snugly on the finished square of the stem. (3) Toothed lock-washer to prevent the stem nut from becoming loose. (4) All parts have been redesigned to give maximum service and strength.

Walworth Quality Bronze Valves are available in Globe (No. 95), Angle (No. 96), or Check (No. 97) types and in sizes from ¼ to 3 inches (check valves ¼ to 2 inches). Ask your Walworth distributor to show you the improved Walworth No. 95 Bronze Valve, or write for further details.

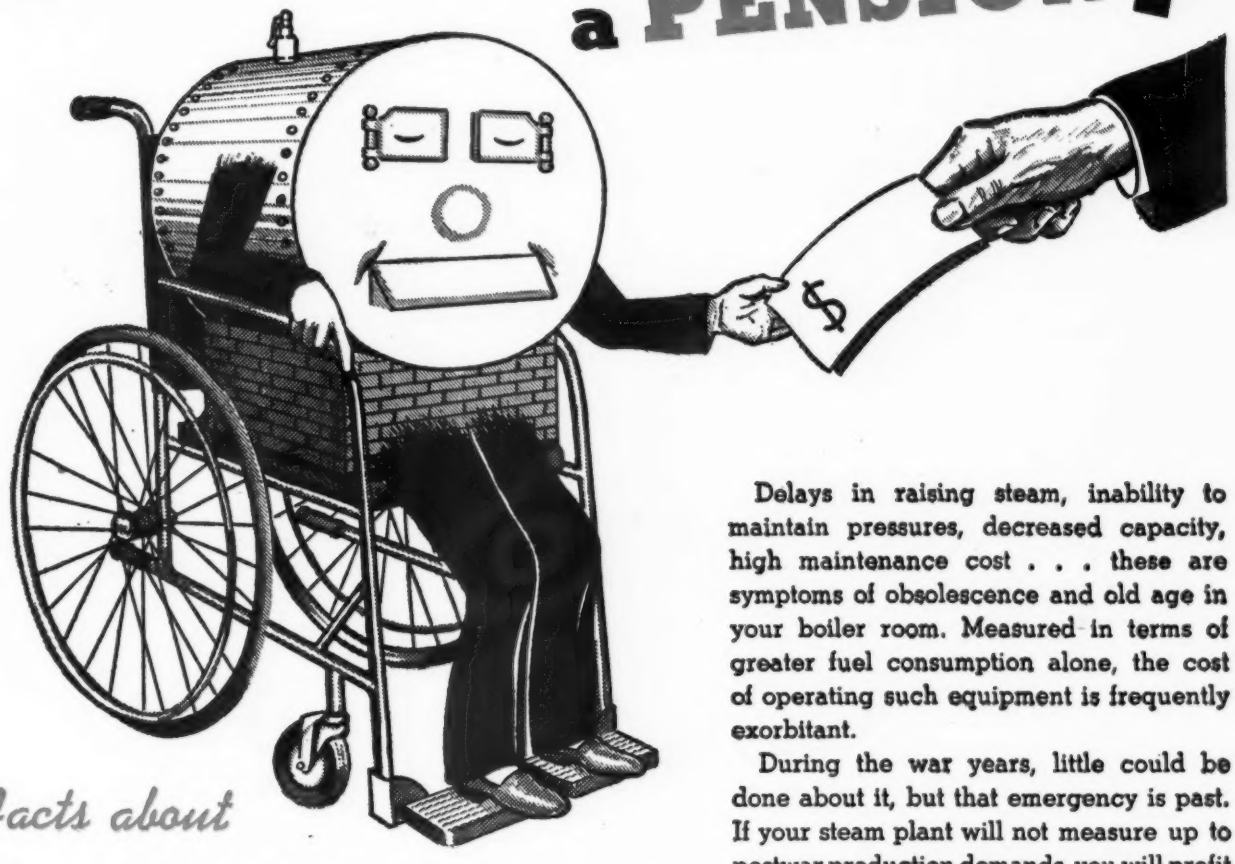
WALWORTH

valves and fittings

60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Are YOU paying your boiler a PENSION?



Delays in raising steam, inability to maintain pressures, decreased capacity, high maintenance cost . . . these are symptoms of obsolescence and old age in your boiler room. Measured in terms of greater fuel consumption alone, the cost of operating such equipment is frequently exorbitant.

During the war years, little could be done about it, but that emergency is past. If your steam plant will not measure up to postwar production demands, you will profit by learning the facts about Superior Steam Generators. Write today for Catalog 101 which gives complete details. It's free.

Facts about

Superior Steam Generators

Automatic Operation — Burning any grade of fuel oil including Bunker C. Units can also be furnished to burn natural gas or with combination gas-oil equipment.

Simple Installation — Shipped completely assembled, your Superior Unit can be operating within 24 hours after it arrives. Installation consists only of connecting the unit with water, electric and oil supply lines, steam head to your load, stack to its outlet.

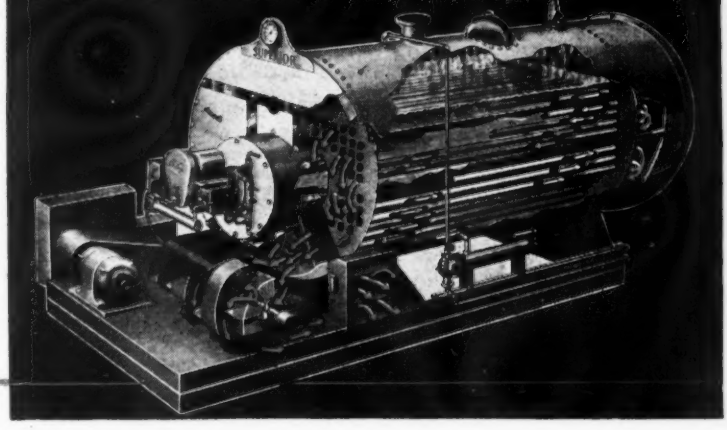
No Expensive Chimney — The *induced* draft fans furnish all air required for maximum rating without need of a chimney other than a vent to carry off combustion gases.

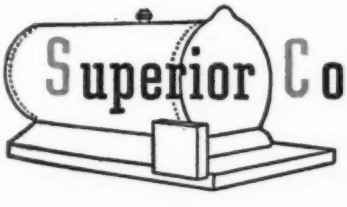
Clean, Quiet Operation — The evenly distributed *induced* draft results in a more quiet operation and eliminates danger of forcing gases into boiler room.

Quality of Steam — The unusually large steam space and the dry pan provided assure dry steam at the nozzle and ample reserve steam capacity. Large evaporating surface promotes quick steaming while preventing surging and foaming prevalent where evaporating surfaces are restricted.

Capacities — Manufactured in 17 sizes from 20 to 500 b.h.p. to operate at pressures from 15 to 200 p.s.i.

The four-pass, *induced* down-draft, fire tube design of Superior Steam Generator (shown below) provides ample heating surfaces which result in high efficiency and quick steaming. Strategically located hand clean-out holes, which make water side accessible for cleaning, add long life to high efficiency.

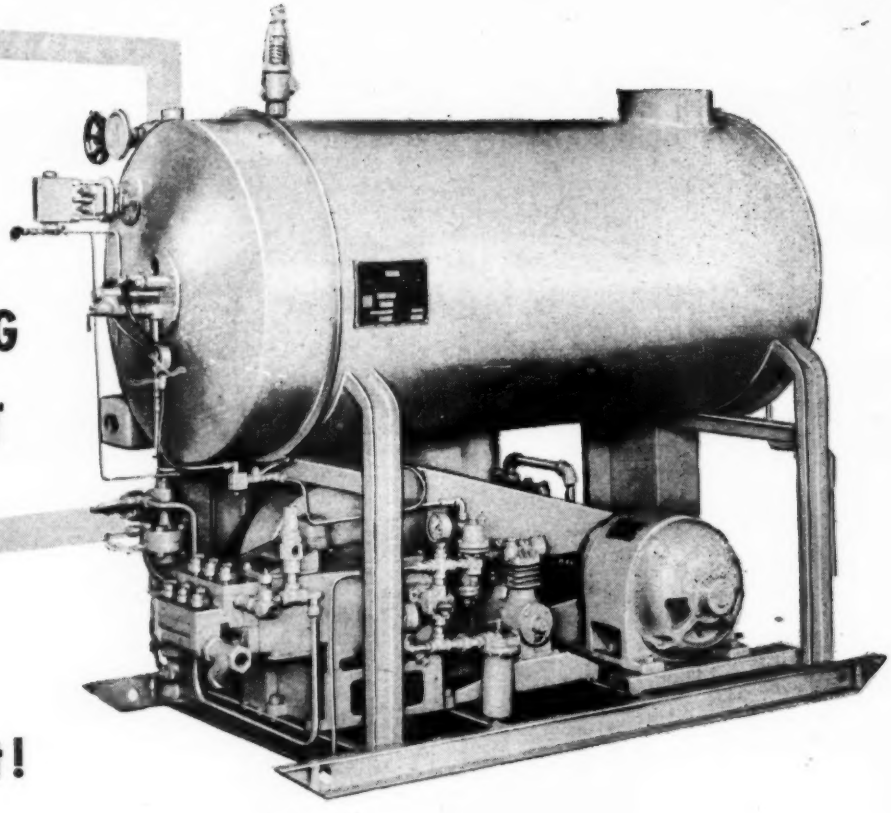




Superior Combustion Industries, inc.

Emmaus, Pa.

MODERN STEAM GENERATING EQUIPMENT



Industry Demands It!

BESLER Supplies It!

THE old-fashioned steam boiler is as obsolete as the horse and buggy. Today's steam users *demand* "packaged" automatic steam plants which bring the steam to their jobs and make it immediately available for power, processing or heating, *when and as they need it.* They demand compact, lightweight units which save plant space and eliminate the need for permanent construction (brick work, foundations, buildings, etc.) and costly piping.

BESLER Automatic Steam Generators are the answer to these *modern* demands. These sturdy, efficient units are the result of many years of activity devoted exclusively to the modernization of steam generating equipment.

They represent a background of engineering and manufacturing know-how that has produced such outstanding products as the Besler Sectional Steam Boiler, the Besler Portable Fog Generator, and the BES·KIL Aerosol Generator.

Here's what you get when you buy BESLER Automatic Steam Generators:

Full steam capacity in 3 minutes or less from a stone cold start.
Instant shut down.
Automatic response to load fluctuations.
Push button starting and stopping.
Outstanding safety features, no explosion possible.
Simple installation . . . new ease of maintenance.
High operating efficiency and economy.

. . . and a host of other features which meet your requirements for modern, low-cost steam plants.

A few desirable territories are still available to qualified dealers

BESLER Automatic Steam Generators are now available in three convenient sizes: 50, 75 and 150 H. P. Phone, wire or write for full information.

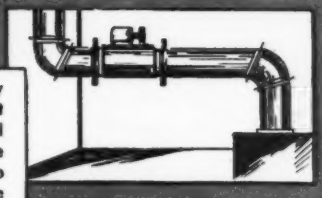
Besler Brings the Steam to Your Job!

BESLER CORPORATION

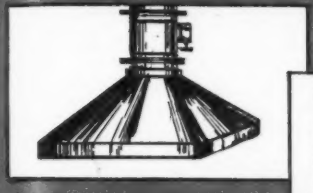
4053 HARLAN STREET • EMERYVILLE 8, CALIFORNIA

AXIAL FLOW FANS-

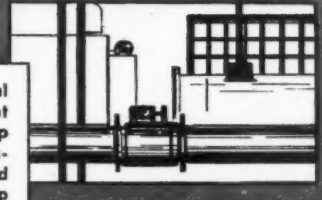
WHEN TO USE THEM TO ADVANTAGE



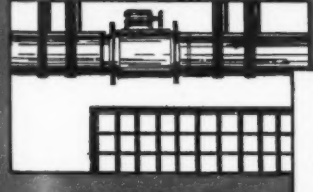
WHEN the fan fits naturally into the middle of a straight duct system. Here the Axial Flow type is installed with the least disturbance, and to special advantage when the system is overhead.



WHEN a vertical air removing system is used — as in exhausting from a hood or paint spray booth—the Axial Flow Fan can be set directly over the opening with the duct straight up.



WHEN space is limited Axial Flow Fans take all straight connections (which take up the least room)—while Centrifugal fans require curved connections, which take up valuable room.



WHEN you have a fan-supporting problem, but still need high air volume. Axial Flows are lighter and smaller than Centrifugals—are more easily supported from ceilings or walls.

Axial Flow Fans fit very well into many industrial and commercial applications where space-saving is important, where an expensive platform can be eliminated, and where straight-line air flow is desirable.

In other cases, they offer no real advantages over Centrifugals and for that reason, Buffalo offers both types.

Bulletin 3533-B gives full details and ratings on Axial Flow Fans. Bulletin 3339 gives the same information on Type LL Centrifugal Fans. Write for copies of both for your files.

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

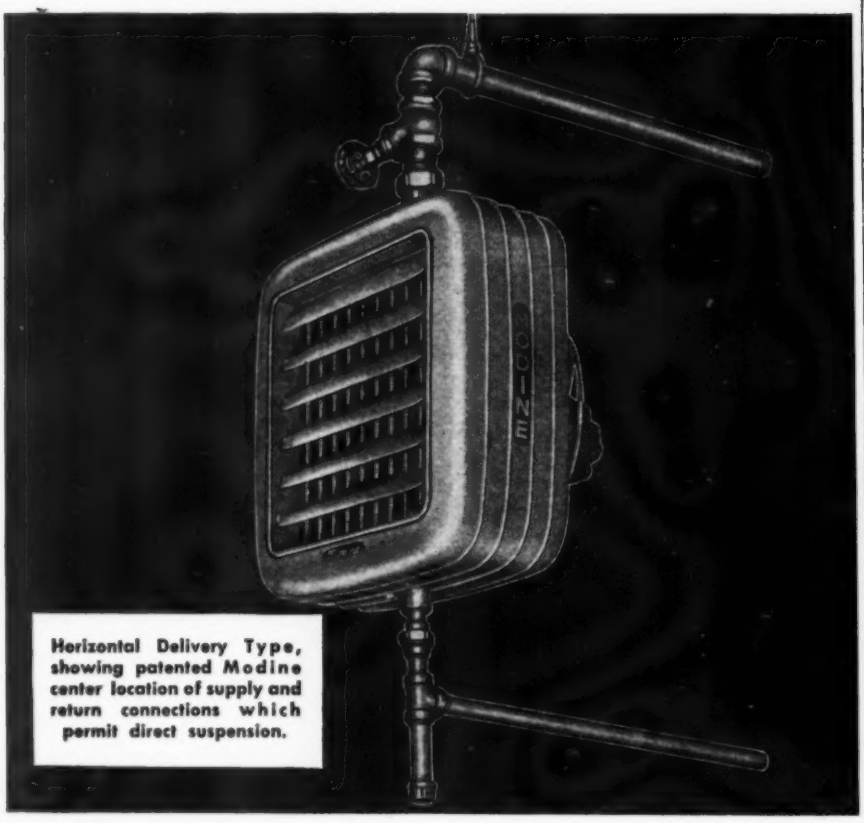
"Buffalo"

AXIAL FLOW FANS

CENTRIFUGAL FANS

LAST WORD

in Unit Heater Design...that's the New Modine Unit Heater Line!



Horizontal Delivery Type, showing patented Modine center location of supply and return connections which permit direct suspension.

TODAY'S GREATEST unit heater value — that's what everybody's calling the new 1947 Modine Unit Heater Line! Compare these outstanding Modine features, and we think you'll agree: Beautiful, modern unit heater design, styled for today's and tomorrow's interiors . . . outstanding engineering that gives you improved heating performance combined with fuel economy, low operating and maintenance costs. Yes, never before has propeller unit heater design been so closely adapted to the expanding applications of unit heating, or to the critical requirements of unit heater application engineers!

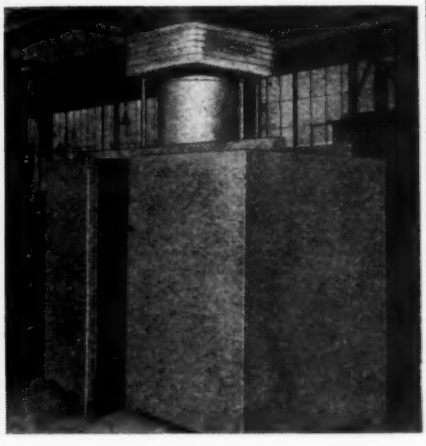
In addition, Modine now gives you a completely integrated unit heater line with *47 basic capacities* for steam and hot water, perfectly coordinated in range of types, sizes, appearance, design and performance: 1) Horizontal Delivery Type for general industrial and commercial applications—2) Vertical Delivery Type for overhead installations — 3) New Power Throw Type for specialized industrial use.

If you're planning to build a new plant or store, investigate the Modine line. For complete information, see the "Where-to-Buy-it" Section of your phone book, or write for free descriptive literature.

Modine UNIT HEATERS

What's New in Unit Heating?

SAVE FLOOR AND WALL SPACE this easy way! Unit heaters mounted overhead in roof trusses or under ceilings use no floor or wall space that is needed for production or storage purposes. Except for special applications, they require no ducts along walls or floors — no inlet and outlet air grilles . . . no special floor or wall construction. Prime advantage for industrial plants, this feature is an important asset in commercial applications where rents are high and floor space is limited.



CUT YOUR DRYING COSTS with a simple drying booth and unit heater! Picture above shows how an efficient drying booth can be constructed of insulating board at minimum expense. Vertical unit heater mounted at top draws in dry room air, heats it and then circulates it rapidly over and around parts to be dried. Air with entrained moisture is dissipated through cracks along lower edges of booth. Doors on front of booth permit bringing in material on pallets.

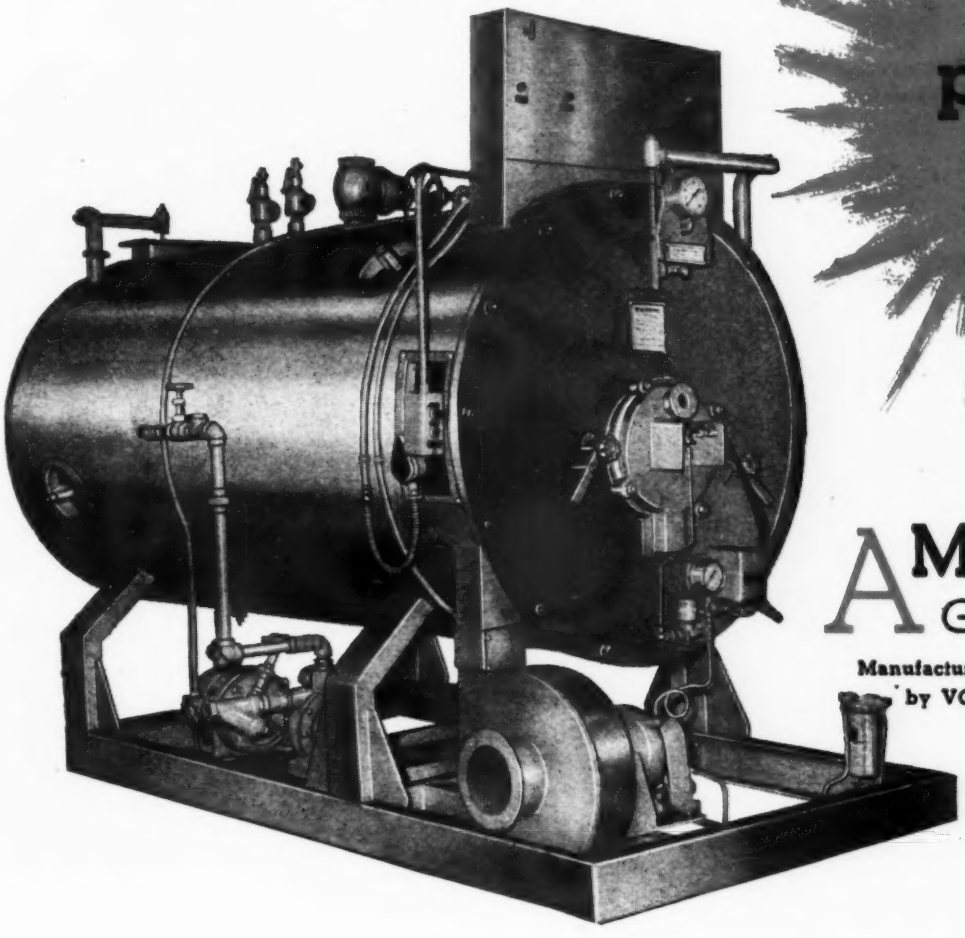
Important:

Right now, in the face of material shortages, we are doing our utmost to meet the tremendous demand for Modine Unit Heaters. If there is delay in filling your order, please be patient. When your new Modines are installed, we think you'll agree they were well worth waiting for.

MODINE MFG. CO.
1830 Racine Street, Racine, Wisconsin

PERFORMANCE . . .

pays off



AMESTEAM GENERATOR

Manufactured under License in Canada by VOLCANO, Ltd., Montreal

The performance of your boiler plant has a vital bearing on your production, both from a quantity and quality viewpoint. Choose a boiler unit that operates day in and day out without necessity of frequent shut-downs. Choose a boiler that does this at low operating cost both in fuel and maintenance.

The AMESTEAM unit will answer your problem and pay you dividends in continuous, highly efficient service, because it is the result of 100 years experience in the boiler industry.

You can surely fill your needs from the many standard sizes, pressures and methods of firing available in the AMESTEAM Generator.

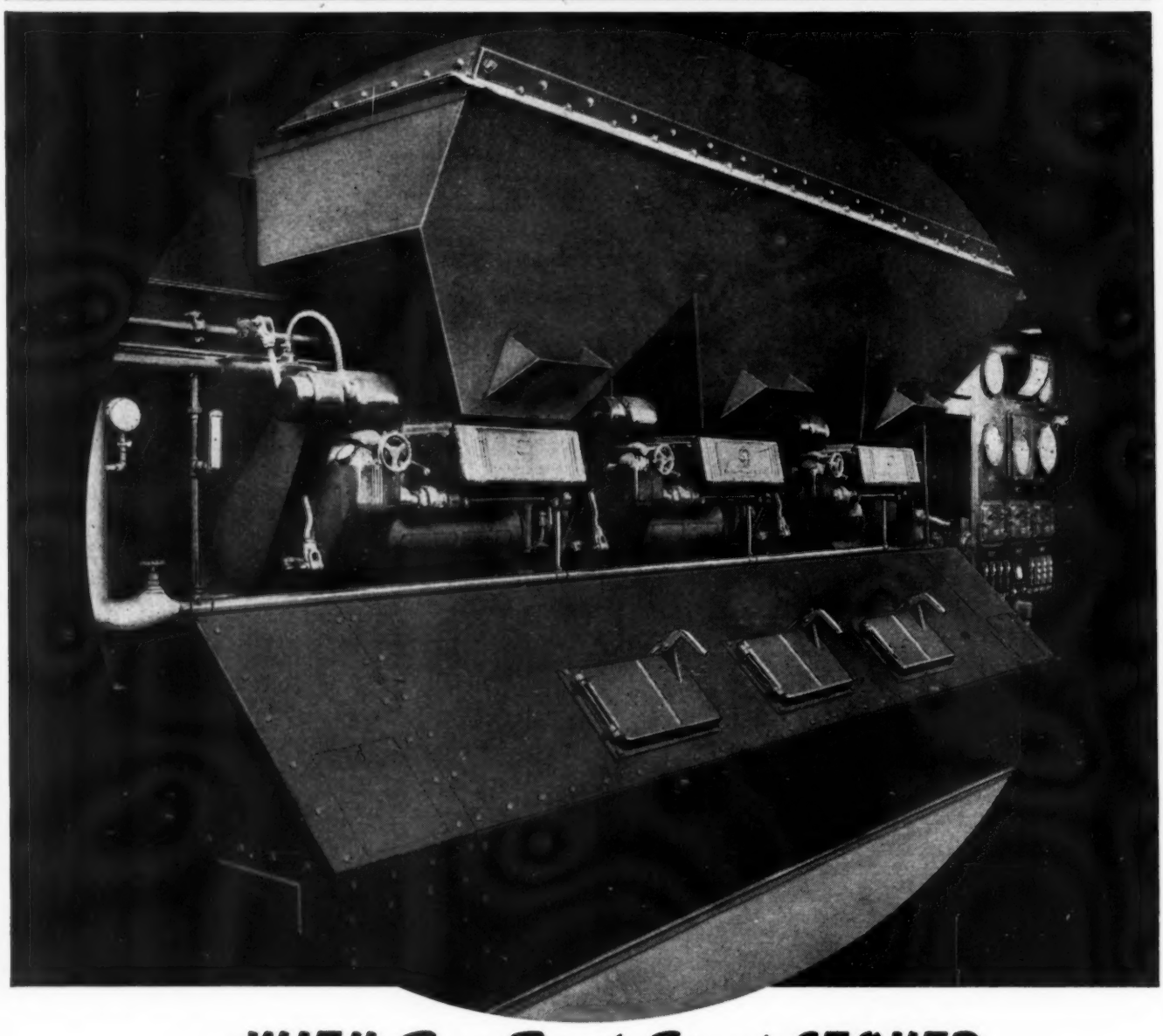
Your wire, letter or phone call will bring you complete information without further obligation.

A Complete Return to the Boiler System, including Feed Water Pump and Condensate Tank with their accessories, is part of the standard equipment with every standard AMESTEAM Generator.

AMES IRON WORKS

BOX 85 · OSWEGO, NEW YORK

The *PROOF* is in the *ASHES*



...WITH *Bros Travl-Spred* STOKER

Proof of the high efficiency of the NEW *Bros* Travl-Spred Stoker is in the ashes. Low in carbon, with almost no clinkers, ash falling from the traveling grate indicates complete consumption of even the slowest burning coals.

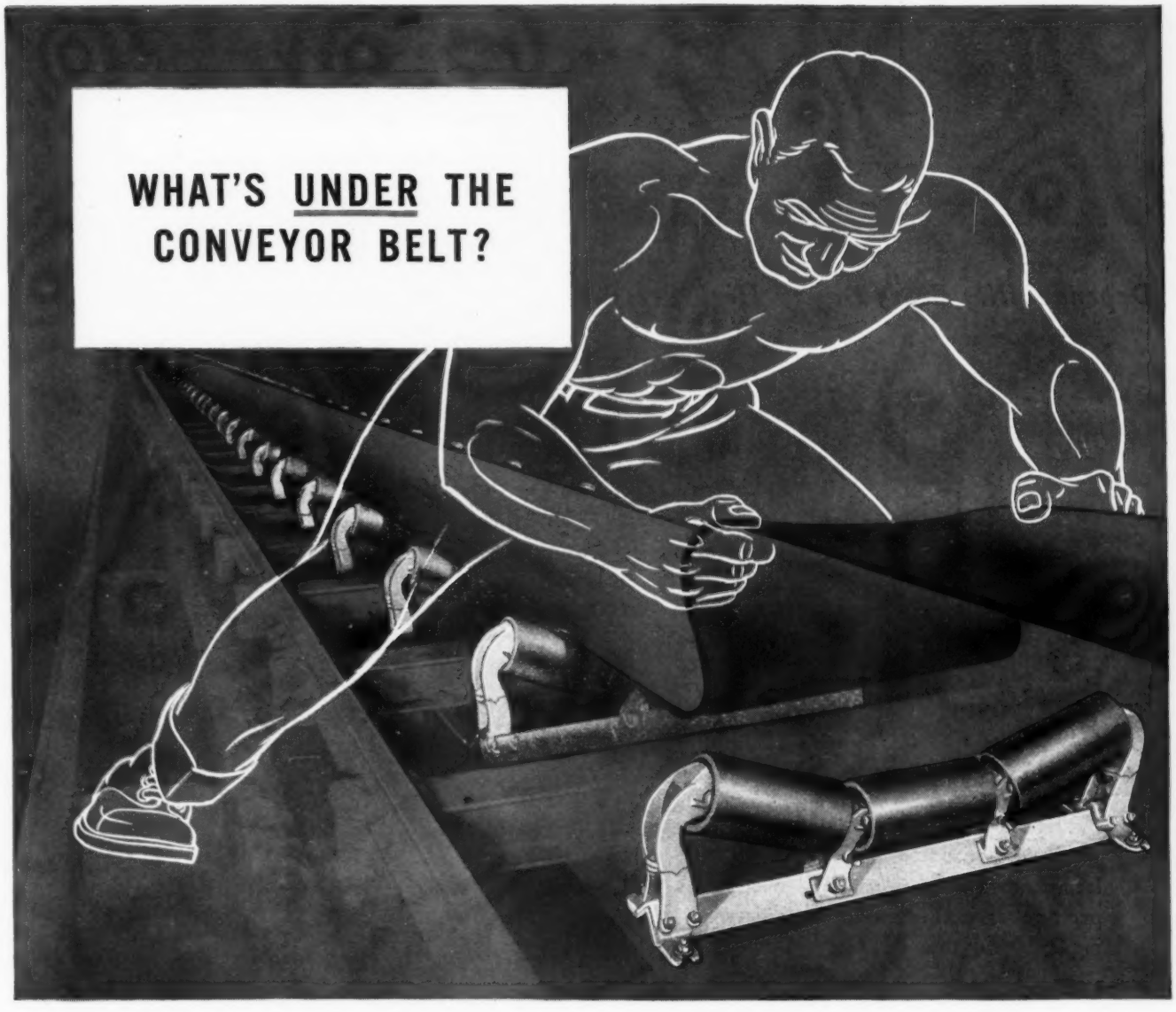
A zoned grate, with a generous burn-off area, assures the correct volume of air through the varying depths of the ash bed. The *Bros* Tuyere type grate meters air through openings below the fuel line at low velocity to eliminate fly ash and disrupted fuel bed. Individual tuyere units with cooling ribs mean longer life free from warping.

Step up steam output, cut power costs with *Bros* Travl-Spred Stoker. The reliable hydraulic drive provides low-cost operation with oil operated pistons applied direct to the stoker main shaft. Positive control of grate speed is provided by a hydraulic flow control valve.

Proof of the economical, efficient operation of the *Bros* Travl-Spred Stoker is this installation at Milwaukee, in the plant of the Chicago, Milwaukee, St. Paul and Pacific Railroad. For complete details write Wm. *Bros* Boiler and Manufacturing Company, Minneapolis 14, Minnesota.

BRŌS

WATER TUBE, FIRE TUBE BOILERS • OVER FEED, UNDER FEED • HYDRAULIC-TRAVL-SPRED STOKERS



The all-important question in belt conveyor design

A look under the belt of the conveyor system you propose buying can be one of the most profitable inspections you ever made.

For the carriers under the belt largely determine the efficiency and economy of the entire system.

See, for example, how you benefit with correctly designed S-A "SACON" carriers as shown above.

You save on bearing travel, bearing life and on starting and running power because the "live" shafts turn with the rollers in ball or roller bearings.

You save on maintenance, because bearings are enclosed in dust and moisture tight self-aligning housings, with labyrinth grease seals... and because Sacons are expertly designed and are ruggedly built of the finest materials... *to keep the belt rolling.*

You save in many other ways with the complete Stephens-Adamson line which includes belt conveyor accessories and carriers specifically designed for every type of Service.

For full information on the conveyor equipment best suited to your needs, get in touch with an S-A engineer or write us direct.

STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. • BELLEVILLE, ONT.

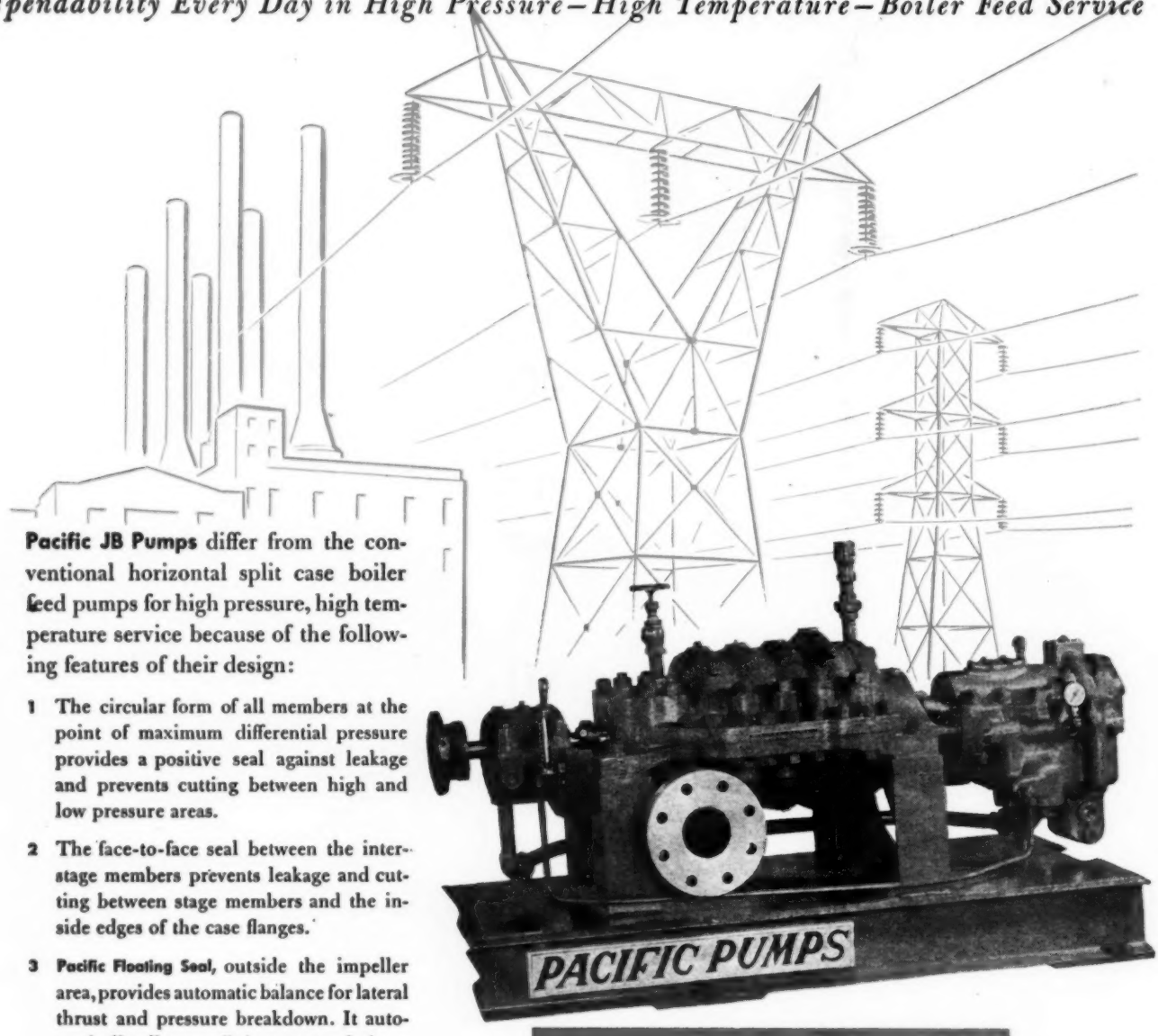
Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

More than 200

PACIFIC JB BOILER FEED PUMPS *Are Proving Their*

Dependability Every Day in High Pressure–High Temperature–Boiler Feed Service



Pacific JB Pumps differ from the conventional horizontal split case boiler feed pumps for high pressure, high temperature service because of the following features of their design:

1 The circular form of all members at the point of maximum differential pressure provides a positive seal against leakage and prevents cutting between high and low pressure areas.

2 The face-to-face seal between the interstage members prevents leakage and cutting between stage members and the inside edges of the case flanges.

3 **Pacific Floating Seal,** outside the impeller area, provides automatic balance for lateral thrust and pressure breakdown. It automatically allows sufficient external circulation to prevent "flashing" and "vapor binding" at reduced capacities and "shutoff."

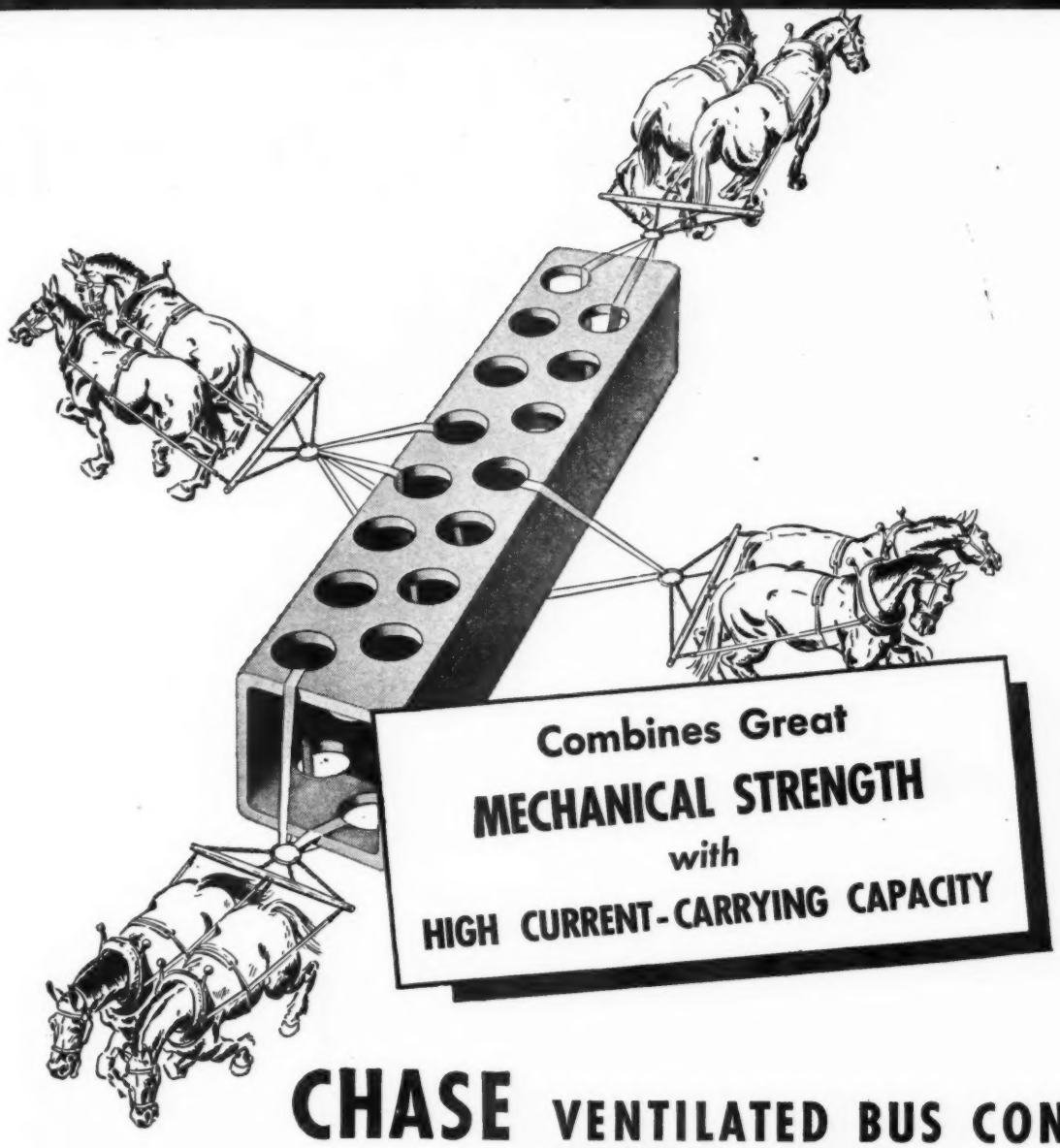
Write for Bulletin 82 for complete information on
TYPE JB BOILER FEED PUMPS

PACIFIC PUMPS, INC.
HUNTINGTON PARK, CALIFORNIA

PACIFIC
Precision Built
PUMPS

One of the Dresser Industries

OFFICES IN ALL PRINCIPAL CITIES – EXPORT OFFICE: 122 E. 42ND STREET, NEW YORK CITY



CHASE VENTILATED BUS CONDUCTOR

For maximum mechanical strength in all directions, nothing can match the square type of bus conductor. This simple one-piece construction of Chase Square Copper Tube also makes it easier to install, since no auxiliary clamping devices are needed.

But Chase engineers didn't stop here. Special ventilating holes in both top and bottom faces of the tube provide internal cooling by natural convection. Thus high current-carrying capacity is combined with great rigidity.

Before deciding upon any new AC bus installations, find out more about Chase Ventilated Bus Conductors...how they save installation time and labor, conserve copper, and stand up to the job efficiently. For information about this and other bus conductor forms, send for the Chase Electrical Handbook. Simply address Dept. PO-57.

Chase *the Nation's Headquarters for* **BRASS & COPPER**

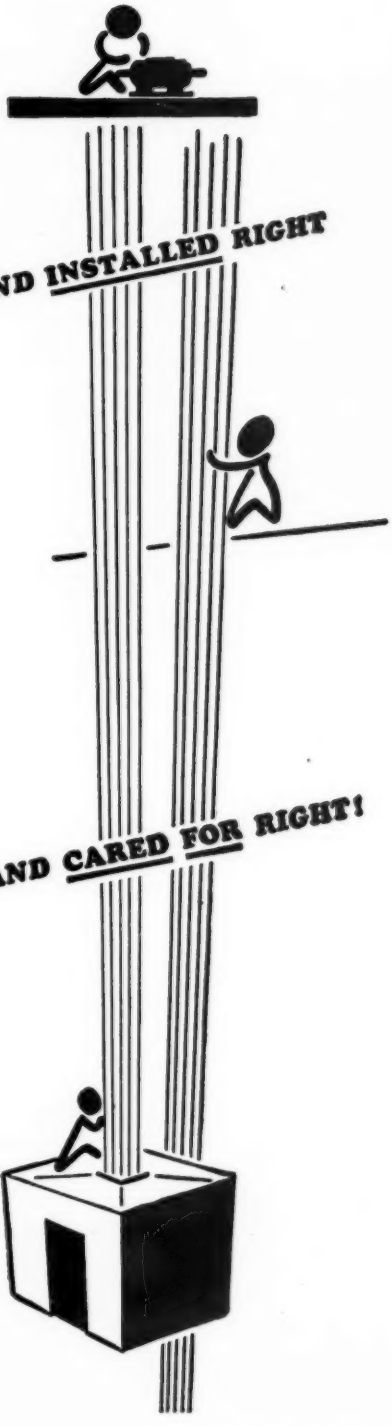
WATERBURY 91, CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS JACKSONVILLE† KANSAS CITY, MO LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST LOUIS WASHINGTON† (†Authorized Sales Offices Only)

is there a little SKIMP *in your elevator?*

—NOT IF IT'S DESIGNED RIGHT, AND BUILT RIGHT,



AND INSTALLED RIGHT AND CARED FOR RIGHT!

OWNERS who do not believe in skimping, have placed more than 30,300 Otis elevators in the United States under Otis Maintenance service. We are responsible for the complete care of their elevator equipment, with rates fixed for a five-year period.

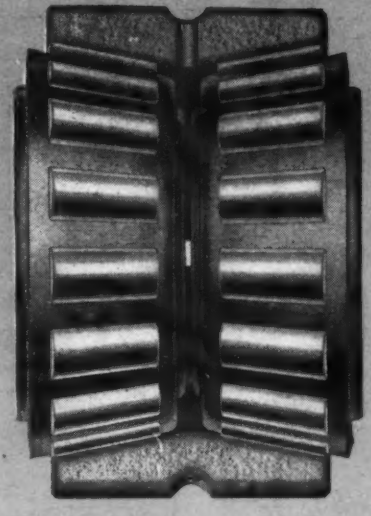
If we skimped anywhere along the line – in design, manufacture, installation or service – it would soon result in repair losses which would come out of *our* pocket.

SO— we don't skimp. Every part we make, every elevator we install and every service we perform is planned to give the most and to last the longest.

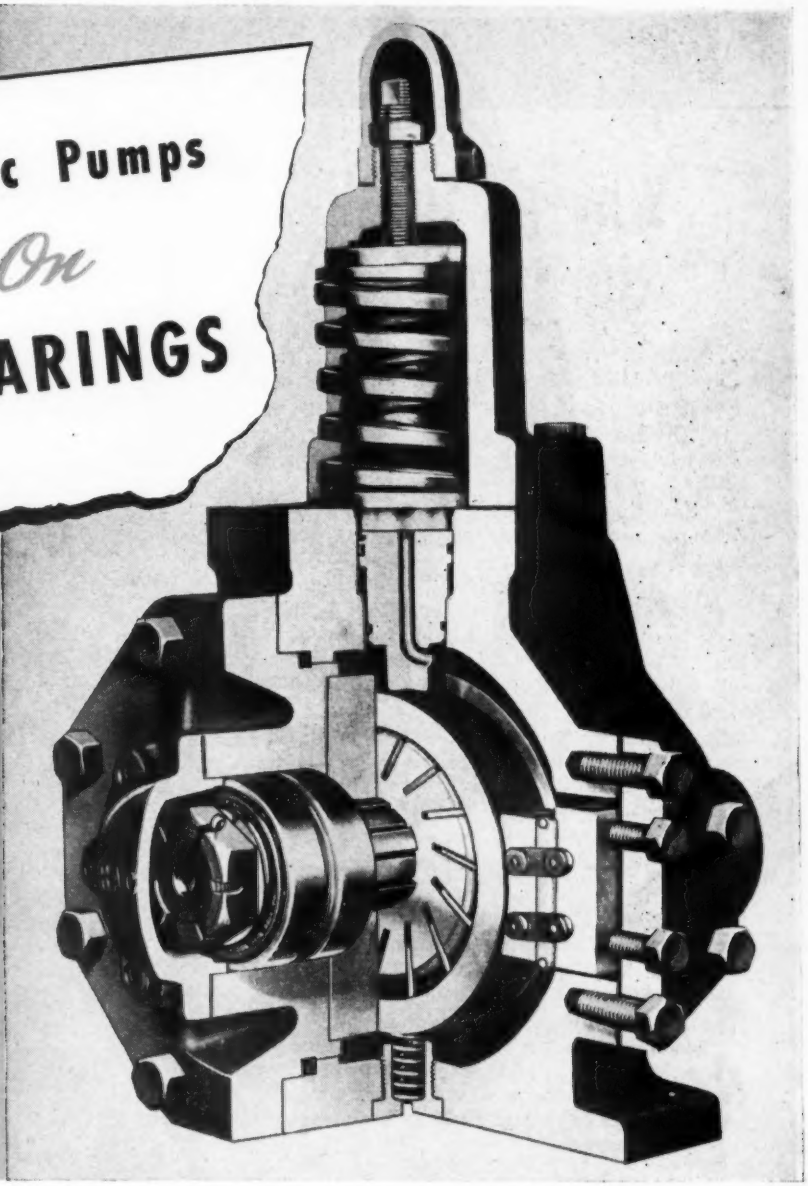
Whether it's installing the new, modernizing the old or maintaining the existing, Otis can serve you best. For the finest in vertical transportation call your local Otis office today.

Otis ELEVATOR COMPANY
OFFICES IN ALL PRINCIPAL CITIES

Racine Hydraulic Pumps *Operate On* TIMKEN BEARINGS



Timken Two-Row Type DO Bearing as used in Racine Hydraulic Pumps.



Racine Variable Volume Hydraulic Pumps are designed for hydraulic power systems using oil as the fluid medium. They are made in three sizes rated at 12, 20 and 30 gallons per minute respectively, with continuous operating pressures up to 1,000 pounds per square inch.

The heart of these pumps is the main shaft and rotor assembly. To assure constant efficient performance, low maintenance and long pump life, the main shaft and rotor must be maintained in correct alignment and proper relationship with adjacent parts; they must also be fully protected against wear, radial, thrust and combined loads.

Knowing this, the Racine Tool and Machine Company mounts the main shaft and rotor assembly on Timken Type DO Tapered Roller Bearings. Thus equipped the pump operates better, lasts longer, costs less for lubrication and maintenance. It pays to specify "Timken Bearing Equipped" and to look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL ⊂⊃ AND THRUST ⊂⊃ LOADS OR ANY COMBINATION

Why go to all the trouble?

Sand-packing prevents flattening of the walls when piping is bent—and the results are easy to see.

But *you* can't see what happens to the metal in the bending process.

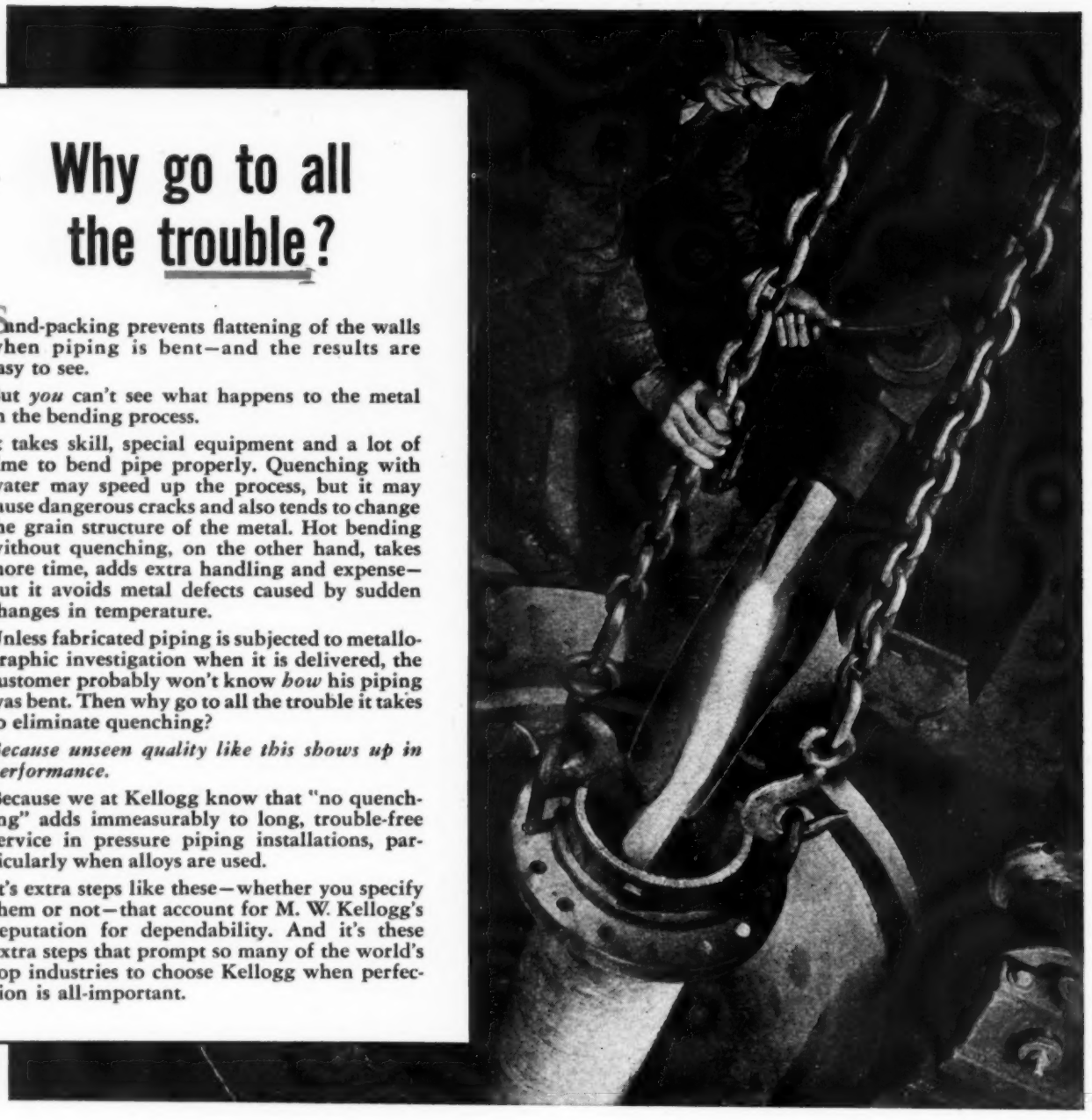
It takes skill, special equipment and a lot of time to bend pipe properly. Quenching with water may speed up the process, but it may cause dangerous cracks and also tends to change the grain structure of the metal. Hot bending without quenching, on the other hand, takes more time, adds extra handling and expense—but it avoids metal defects caused by sudden changes in temperature.

Unless fabricated piping is subjected to metallographic investigation when it is delivered, the customer probably won't know *how* his piping was bent. Then why go to all the trouble it takes to eliminate quenching?

Because unseen quality like this shows up in performance.

Because we at Kellogg know that "no quenching" adds immeasurably to long, trouble-free service in pressure piping installations, particularly when alloys are used.

It's extra steps like these—whether you specify them or not—that account for M. W. Kellogg's reputation for dependability. And it's these extra steps that prompt so many of the world's top industries to choose Kellogg when perfection is all-important.



FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
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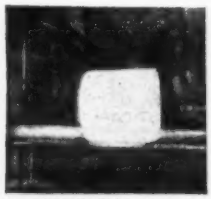
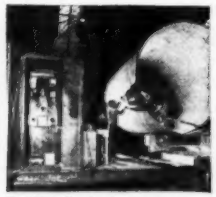
VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.



Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

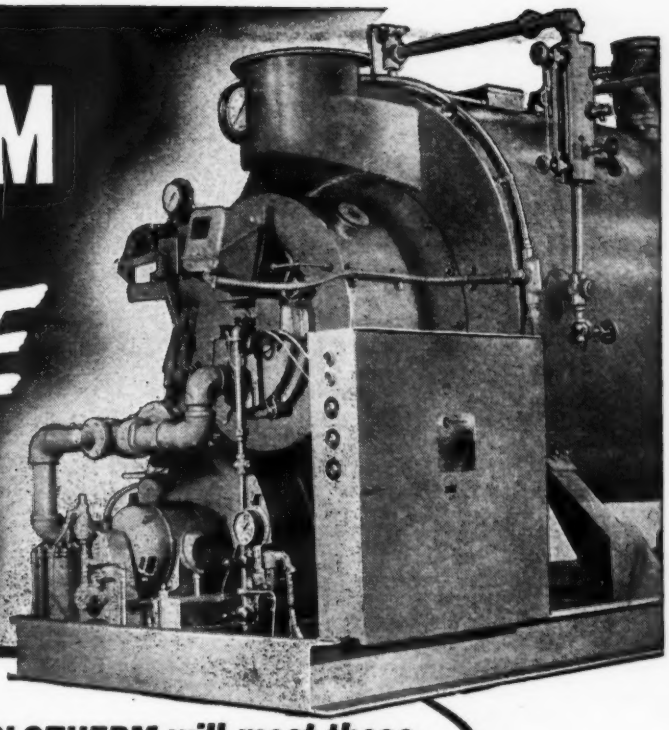


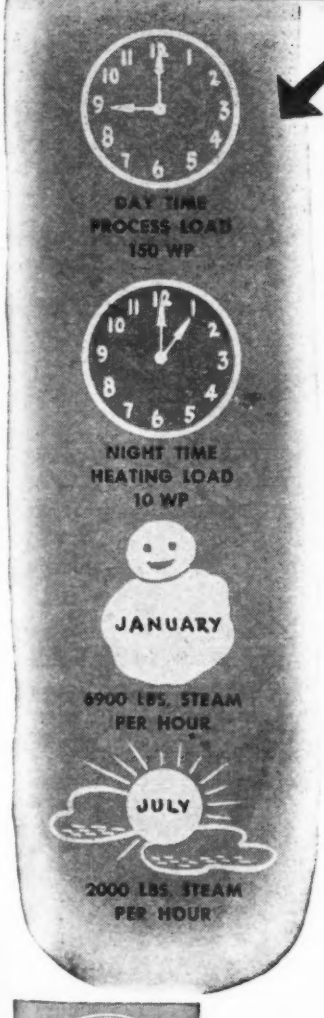
Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

CYCLOTHERM
is the
FLEXIBLE
STEAM GENERATOR





A single CYCLOTHERM will meet these varied steam demands—automatically modulating its firing rate to steam demand—A battery of CYCLOTHERMS will give you even greater flexibility

Designed to meet variable steam demands without loss of efficiency or economy

Whatever your need for steam, there is a Cyclotherm Steam Generator to do your job—dependably and economically. Sizes range from 10 to 300 HP; with operating pressures from 15 to 200 psi. If you check the features that measure value you'll see why Cyclotherm should be your 1st choice.

SIMPLIFIED DESIGN — Cyclotherm's exclusive combustion method permits simplified overall design and 2 pass boiler construction. Burner and boiler engineered as an integral unit.

PERFORMANCE — Cyclotherm provides steam automatically as you need it. Overall thermal efficiency will be not less than 80%.

ECONOMY OF OPERATION — Cyclotherm units may be fired with any liquid or gaseous fuel with maximum efficiency. Automatic modulation of flame on units 80 HP and up.

LOW UPKEEP — Unique combustion principle with 2 pass boiler assures longer life, fewer and easier inspections and "clean-outs".

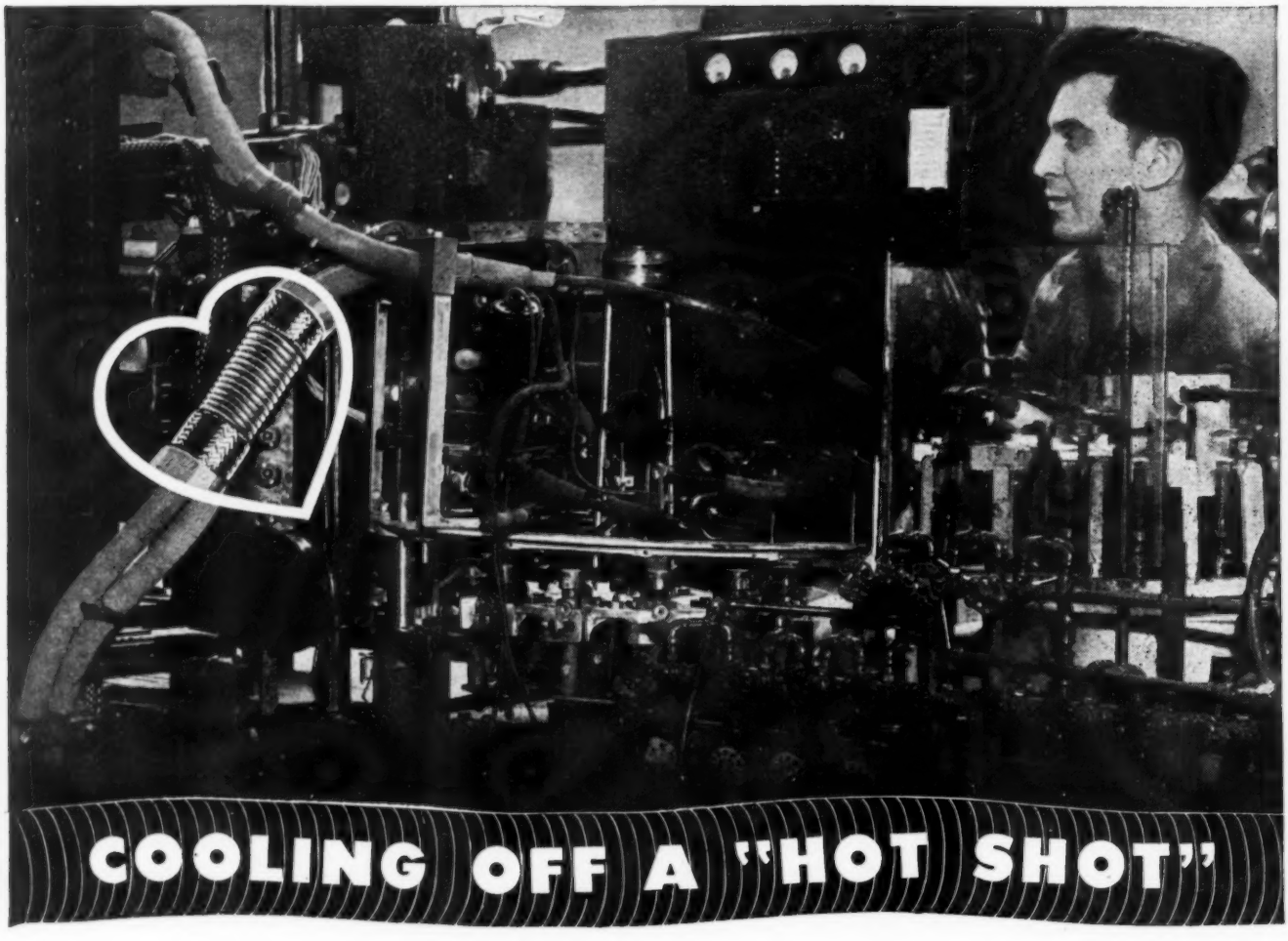
INITIAL COST — Cyclotherm units are low in cost; easy and inexpensive to install. Delivered ready to produce steam; require no special foundation.

IT'S YOUR BEST BUY!

Phone, wire or write for full information

CYCLOTHERM STEAM GENERATORS

CYCLOTHERM CORPORATION, 90 BROAD STREET, BOX 902, NEW YORK 4, N. Y.



COOLING OFF A "HOT SHOT"

Penflex "Flexineering" solves problem of conducting and cooling a 3500-volt "shot" in vacuum tube plant.

One well-known vacuum tube manufacturer developed several powerful induction heat "bombarders" for forming the vacuum in radio tubes. A 3500-volt "shot" quickly generates 950°F. in the tubes . . . exhausts the air . . . forms a vacuum, speedily, efficiently.

But—a problem arose. They needed a good conductor to carry the "hot shot" to the machine head—one that could be kept cool, yet remain flexible. Various wiring arrangements and cooling devices were tried but each proved impractical. Then Penflexweld tubing was applied and—the problem vanished!

The copper construction of Penflexweld furnishes an ideal conductor, while cold water circulating through the tubing keeps it cool. Penflexweld flexes easily with constant machine motion. Wrapped rubber insulation protects operators from shock. The higher efficiency developed by the use of Penflexweld eliminated the need for larger and more expensive bombarder units.

Penflex "Flexineering" (the science of engineering each type of flexible metallic tubing to the particular problem) can help solve similar problems on production, maintenance, and product design in your plant. For helpful engineering service and a complete line of metallic hose and tubing from ⅛" I.D. to 30" I.D. in all types . . . for all uses . . . call on Penflex. Write today for additional data on the above case history.

PENFLEX SALES COMPANY

Division of

PENNSYLVANIA FLEXIBLE METALLIC TUBING COMPANY

7238 Powers Lane — Philadelphia 42, Pa.

BRANCH SALES OFFICES—BOSTON • NEW YORK • SYRACUSE • CLEVELAND • CHICAGO • HOUSTON • LOS ANGELES

Penflex... HEART OF INDUSTRY'S LIFE LINES

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7 BIG FEATURES

- STANDARD MOTORS
- MECHANICAL SEAL
- SPRING-TYPE FLEXIBLE COUPLING
- EASY TO SERVICE
- INTERCHANGEABLE PARTS
- COMPACT DESIGN
- COMPETITIVE PRICE

B & G SERIES 1522

Here's the pump that licks tough pumping situations . . . offering a combination of features which make it immune to usual causes of pump trouble.

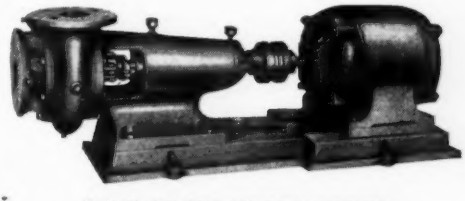
The motors employed are standard units, with replacements readily obtainable from motor manufacturers' stock. A Mechanical Seal, instead of a stuffing box adds materially to the length of trouble-free service, especially where the pumped liquid contains foreign matter which is damaging to the ordinary stuffing box. The Seal is self-lubricating and eliminates the customary leakage through the packing gland.

The unit is easily serviced. Removal of a few bolts permits separation into three parts—motor, bearing bracket sub-assembly and pump body. The bearing bracket sub-assembly, including shaft and sleeve bearings, is manufactured to close tolerances and is interchangeable in all B & G Series 1522 Pumps.

These pumps are available as all-iron, bronze-fitted or all-bronze units. Send for descriptive literature.

B & G SERIES OC-1 HEAT EXCHANGER

For processes involving the exchange of heat between liquids, this B & G unit is suitable for a wide range of applications. Sturdy and compact in design, it has semi-floating heads, removable shell bonnets and straight, easily removed, easily cleaned tubes.



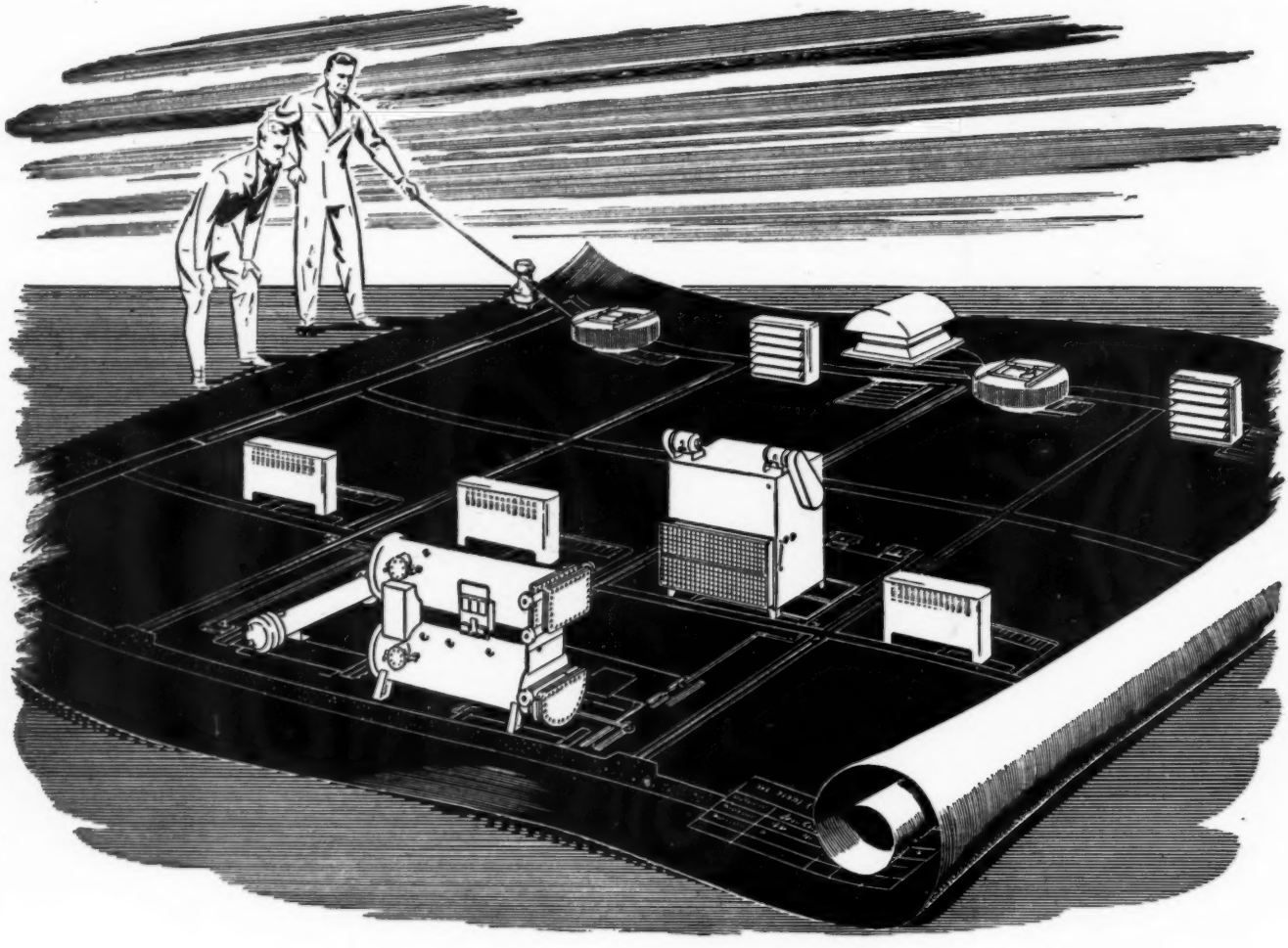
B & G CENTRIFUGAL PUMPS

A complete line of pumps with semi-open or enclosed impellers. Motors flexible coupled as illustrated, or integral with pumps. Send for Catalog CP-843.

Hydro-Flo* PRODUCTS

BELL & GOSSETT COMPANY

Dept. AA-36 MORTON GROVE, ILLINOIS *REG. U. S. PAT. OFF.



THE DESIGN OF AIR CONDITIONING SYSTEMS IS MADE EASIER BY ENGINEERED AIR CONDITIONING

The designing of a true air conditioning system is a complicated problem, since many elements are involved. If the architect or engineer who plans the system can draw on one source instead of many for most of the products he needs—and if these products are engineered to work together—his job is made easier, and the resulting system is appreciably better.

Thus it is that the architect, engineer, and contractor look to Trane Engineered Air Conditioning. Here, at *one source,* they find the most complete line of products in the industry. More than that, they find products that are designed and built together to *work together*—for systems that unerringly perform to engineering standards in creating heating, cooling, humidification, dehumidification, air cleansing and ventilation singly or in any combination.

Trane Heating Systems and Air Conditioning Systems—backed by the *undivided responsibility* of one manufacturer—are designed for each application by the architect, engineer, or contractor. Co-operating with them are 85 Trane Field Offices in all parts of the country.

* * *

The Convector-radiator—modern successor to the old-fashioned cast iron radiator—has been engineered by Trane for universal application to steam and hot water heating systems, and is being produced in quantity so you can soon secure it from local distributors' stocks.

TRANE

Manufacturing Engineers of Equipment for
HEATING AND AIR CONDITIONING

THE TRANE COMPANY, LA CROSSE, WISCONSIN • *Also* TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO

Firm Vapor Seal

Pressure-Tight

Positive Control

Automatic Relief

Vacuum Protected

Simple, Effective

BS&B Pressure-Vacuum VENT VALVES

Here's positive protection against vapor loss when storing benzol, alcohol, gasoline and other products requiring slight pressure for economical storage. Black, Sivalls & Bryson Vent Valves guard against both over-pressure and excessive vacuum. An exclusive, flexible gasket provides a tight seal during normal operations. Over-pressure lifts the hinged cover, breaks the seal, allows vapors to escape until normal pressure is restored. Excessive vacuum causes atmospheric pressure to lift the gasket, permitting in-breathing.

B S & B Vent Valves are available in a full-range of sizes . . . 2 to 24 inches. Standard models have cast iron body and cast aluminum cover; B S & B Vent Valves are also available in bronze, monel, stainless or combinations of these metals. Large Vent Valves also may be used as manhole openings. Many are in use as supplementary relief valves.

Write today for complete information. Address Special Products Division, Black, Sivalls & Bryson, Power and Light Building, Kansas City 6, Missouri.

SPECIFICATIONS

Model Number	Size, Inches	Standard Opening Pressure, Ounces	Maximum Opening Pressure, Ounces	Standard Opening Vacuum, Ounces
2VVH	2	3	16	½
3VVH	3	3	16	½
4VVH	4	2	16	½
6VVH	6	2	16	½
8VVH	8	2	16	½
10VVH	10	2	16	½
12VVH	12	2	10	½
16VVH	16	2	8	½
20VVH	20	2	6	½
24VVH	24	1½	4	½

FOREIGN INQUIRIES INVITED

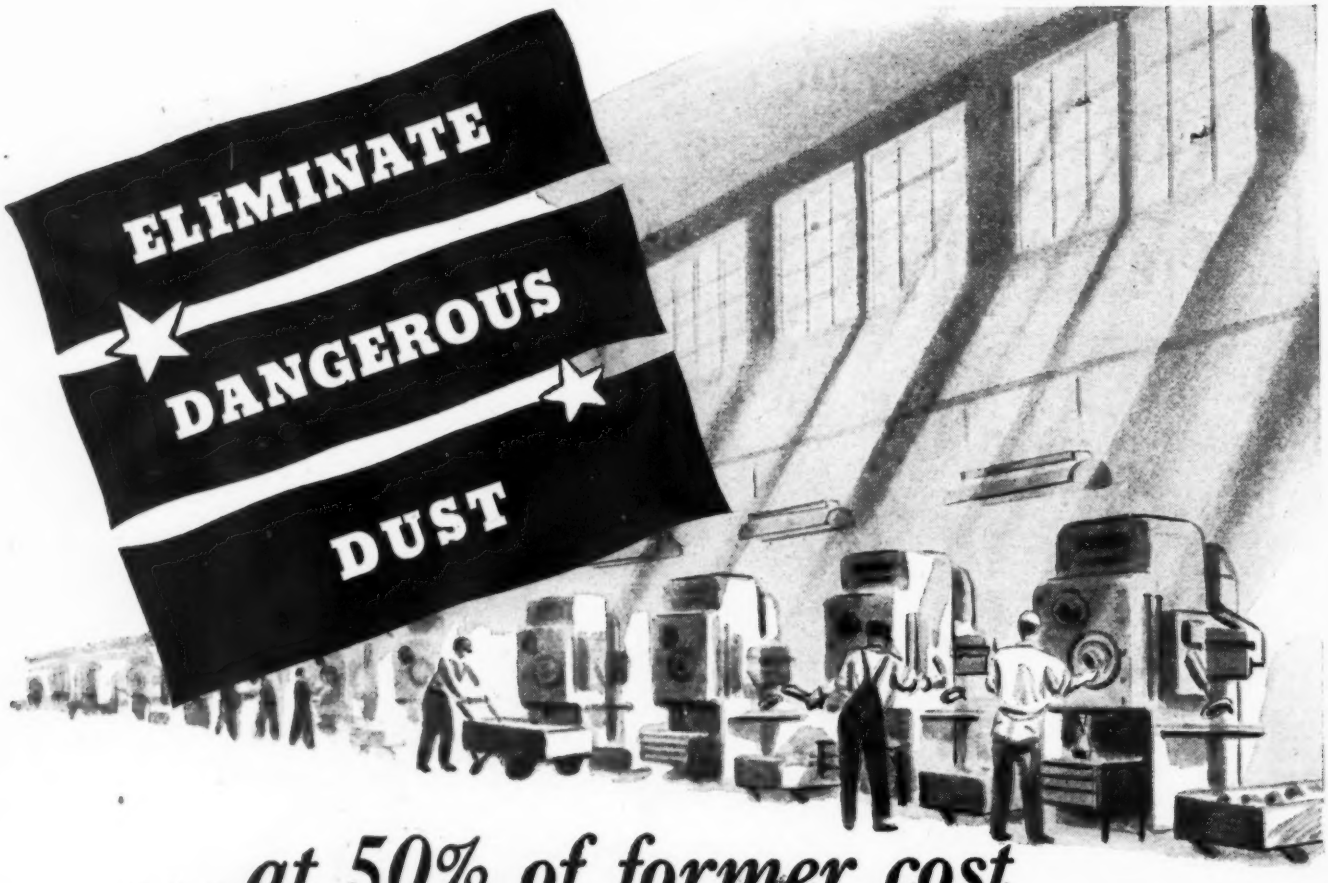
EFFICIENCY

Cable Address: BLACK, KANSAS CITY, U.S.A.

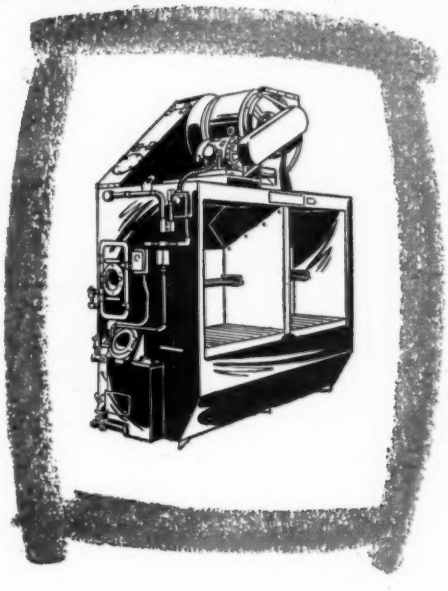
BLACK, SIVALLS & BRYSON, INC.

RELIABILITY

KANSAS CITY, MO.
CASPER, WYO.
OKLAHOMA CITY, OKLA.
CALGARY, ALTA.



. . . at 50% of former cost



Dust is dangerous, costly and downright annoying. Frequently explosive, always damaging to equipment and health, it is a major factor in high insurance rates and labor turnover. So why tolerate it when the best dust collection equipment made can be obtained from surplus at ½ price or less? Yes! Equipment suitable for every industry with a dust problem is now available from WAA. Some unused, some used, but all inexpensive and easy to get. Simply contact: Chief, Sales Section 67, in your nearest WAA Regional Office listed below. Do it while wide selections are still available.

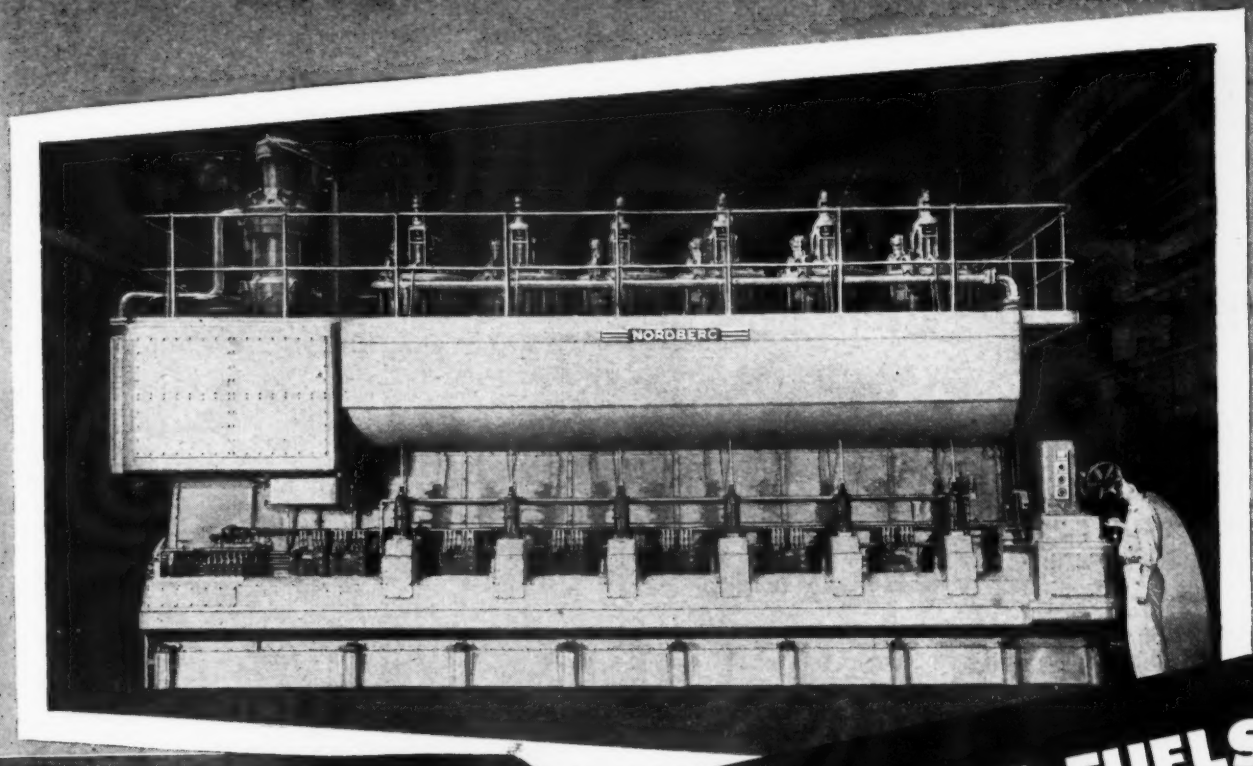
OFFICE OF GENERAL DISPOSAL

WAR ASSETS ADMINISTRATION

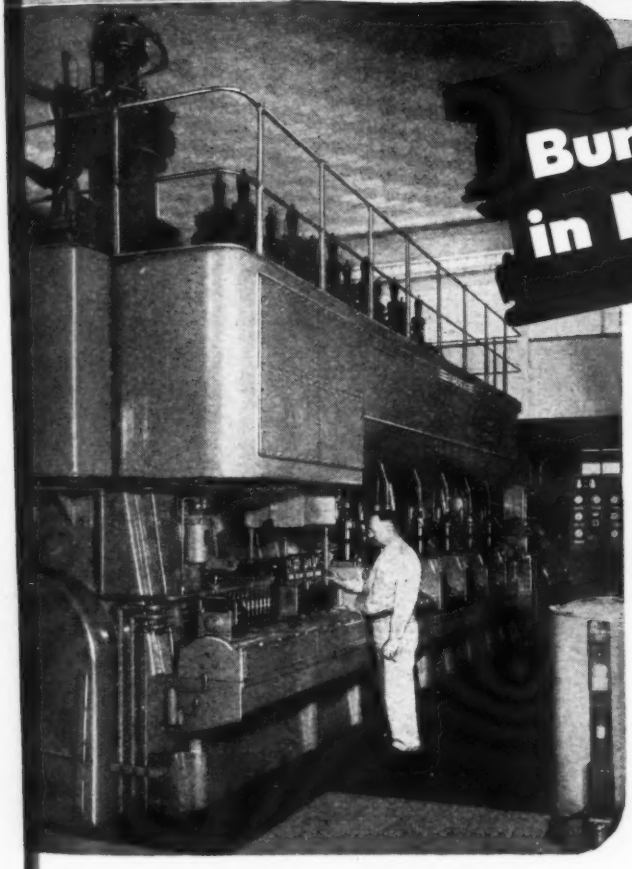
GOVERNMENT WAA SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver Detroit • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • San Antonio • San Francisco • Seattle • Tulsa

1051



Burn GAS and OIL FUELS in NORDBERG DIESELS



Shop and installation views of a six cylinder, 2400 horsepower, two-cycle, convertible gas and oil burning Diesel engine in the municipal power plant at Estherville, Iowa.

• Approximately 150,000 horsepower of convertible gas and oil burning Nordberg Diesels are in successful operation. In localities where natural gas is available, Nordberg Diesel-Gas engines have shown remarkably low power production costs. Since these engines operate on either gas or oil fuels without change of major engine parts, it is possible to burn the most economical fuel. . . . Nordberg Diesels arranged for gas burning are built in two and four-cycle types in sizes up to 8500 in a single unit. If you are contemplating additional power equipment, investigate the merits of dependable and economical Nordberg gas burning Diesel engines.

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN

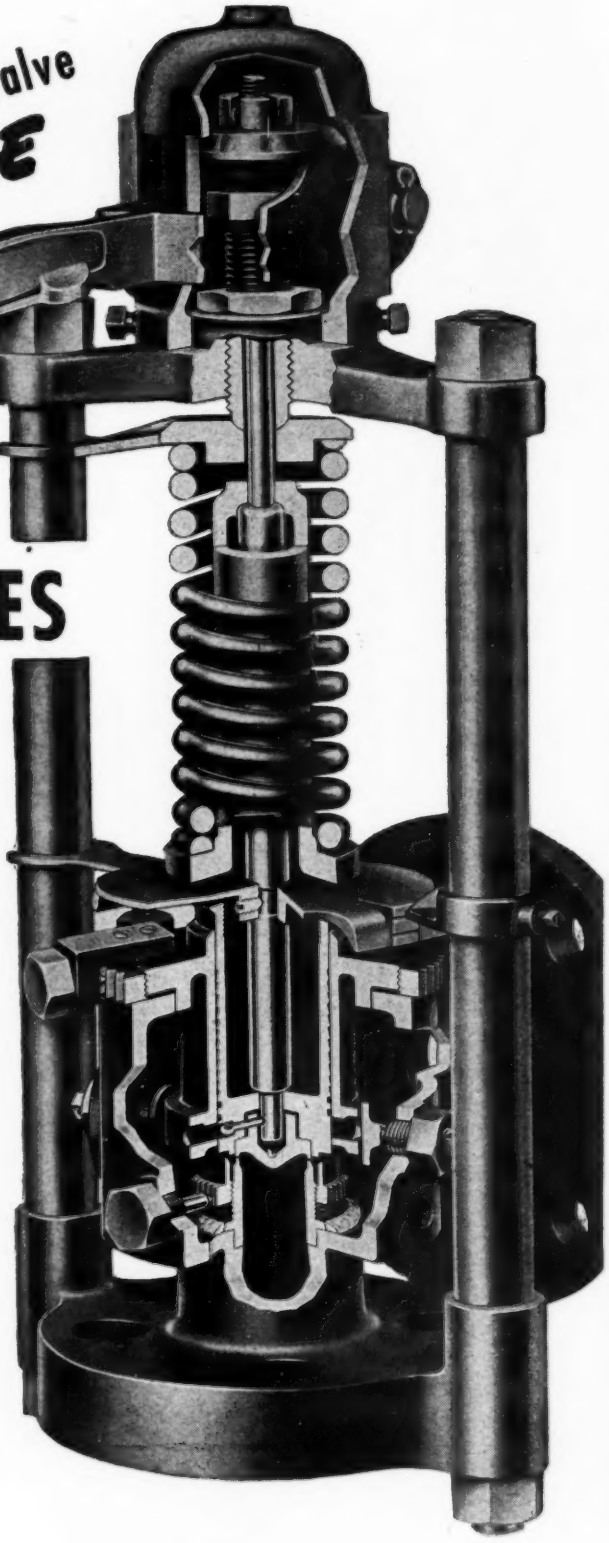
NORDBERG
DIESEL ENGINES

NORDBERG MACHINERY

You Can See for Yourself . . .

WHY the Foster 38-SV Safety Valve is ESPECIALLY SUITABLE FOR

HIGH PRESSURES HIGH TEMPERATURES



Pressures up to 3000 pounds and temperatures of 1200° F. are easily handled by the Foster Type 38-SV Super-Jet Safety Valve—it was designed especially for just these exacting requirements! It's no mere "beefed-up" low-pressure valve—rather it's a basic new design for high-pressure service.

Only the Foster 38-SV Safety Valve gives you all these advantages:

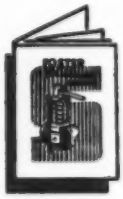
1 . . . ***Exceptional steam economy*** because . . . it reseats as low as 1% below popping pressure . . . reseating is positive; without pounding or chatter . . . blowdown is adjustable from 8% down to 1%.

2 . . . ***Unaffected by temperature changes*** because . . . frame rod construction makes crawl negligible . . . deflector protects spring and rods from escaping steam.

3 . . . ***Maximum protection*** because . . . full opening is practically instantaneous . . . full rated nozzle capacity is available at popping pressure . . . once set under operating conditions, its popping point is constant.

4 . . . ***Positive reseating*** because . . . floating disc design . . . steam-centered piston . . . permanently flat seats.

Specify the Foster 38-SV Super-Jet Safety Valve for the finest in high-pressure protection!



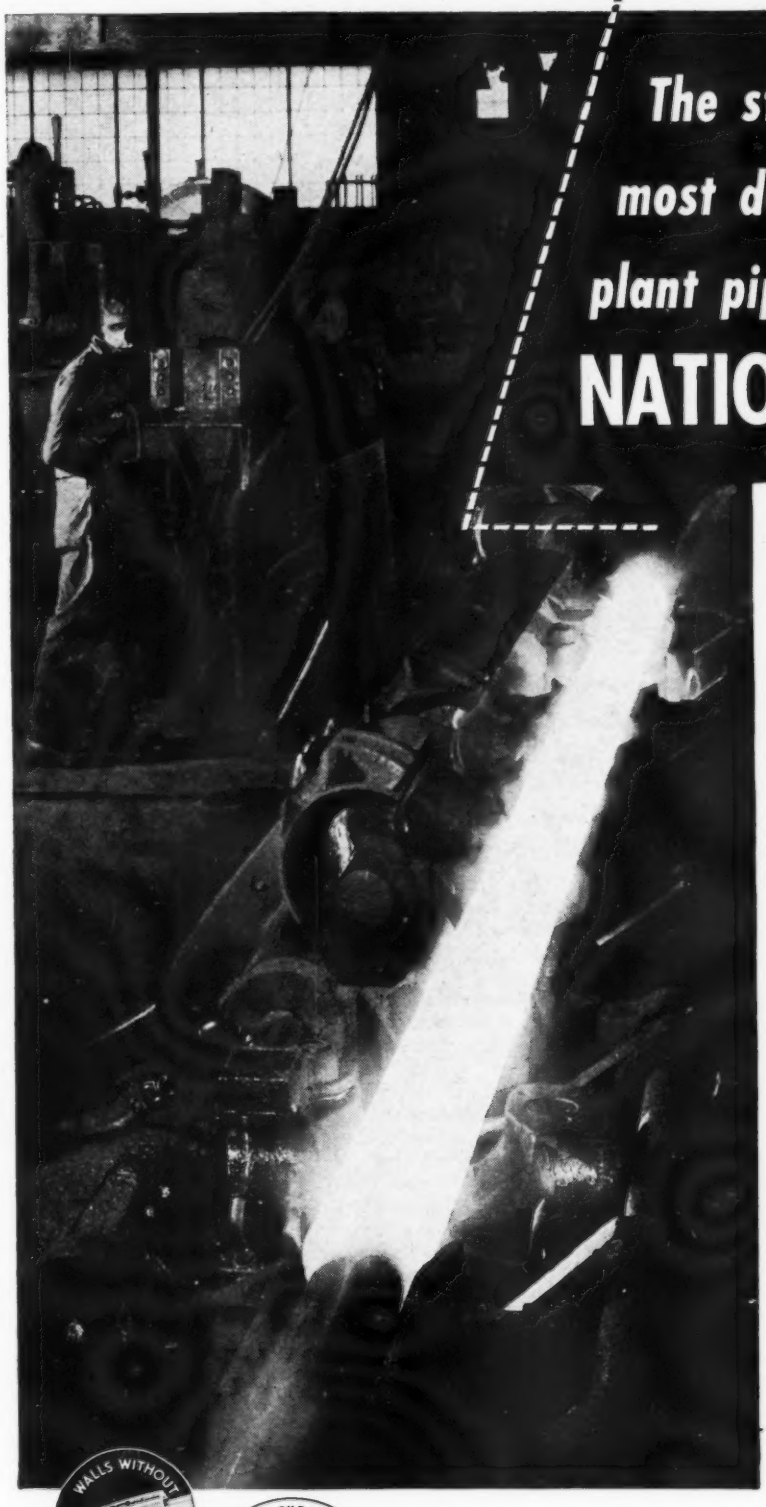
Complete details of the Foster 38-SV Super-Jet Safety Valve, for pressures up to 3000 pounds and temperatures up to 1200° F., are given in Bulletin 25. Write for it today!

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS... PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK 1, N. J.

...HERE'S WHERE IT STARTS!



The strongest, most uniform, most dependable power plant piping—

NATIONAL SEAMLESS

Piercing a solid billet of steel to form a seamless tube!

No other process of tubemaking so drastically tests the *quality* of the steel. Only the soundest, most uniform material could withstand such rigorous treatment without disclosing even minor defects.

It is the only process that absolutely removes all uncertainty regarding uniform wall strength. For no method of joining metals yet devised, can provide, with invariable certainty, the structural homogeneity and the assured safety, security, and dependability of a solid forging. And a NATIONAL Seamless pipe or tube is exactly that—one continuous piece of steel without weld of any kind, structurally sound from end to end.

That is why in many cases involving severe or hazardous service, the use of *seamless* pipe is mandatory. That is why NATIONAL Seamless Pipe—the famous "Walls without Welds"—has never been surpassed for power plant service.

And remember this. The uniform wall strength of NATIONAL Seamless Pipe has a direct and beneficial relation to bending, expanding, flanging, beading and all other working of the pipe. NATIONAL Seamless thus not only stands for the *safest* pipe ever developed for critical power plant service, but for the easiest pipe to work with.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY · USS STEEL · UNITED STATES STEEL

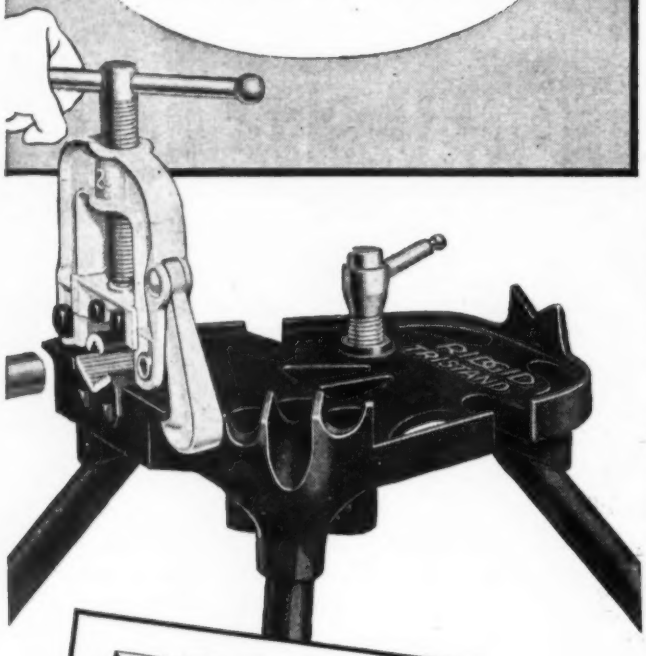
NATIONAL TUBE COMPANY

PITTSBURGH, PA.

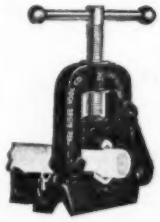
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

A PIPE VISE *That's a handy Work Bench*



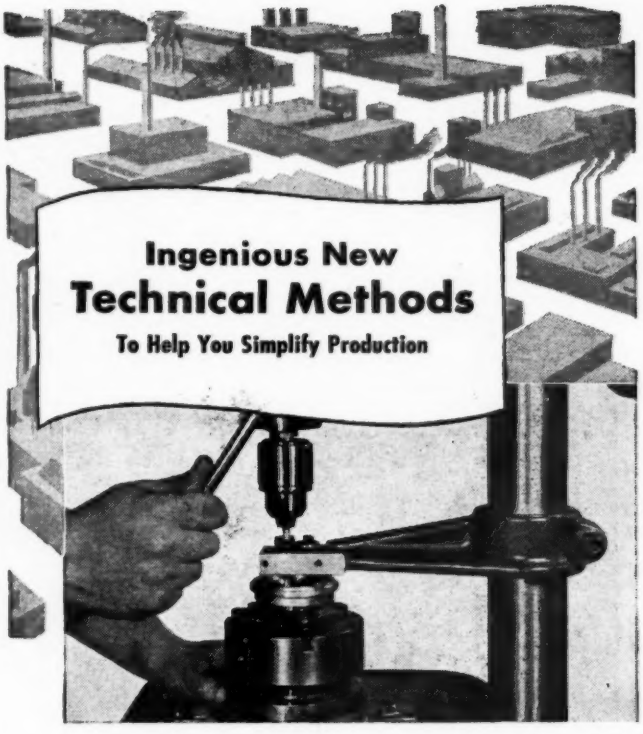
RIGID TRISTAND is portable and roomy —a big worksaver



RIGID
Vises include bench, post, stand models, yoke and chain.

● You can carry the Tristand easily to and around the job—legs fold in—and you've got a convenient work-bench. Big tray for dope pot, oil can, slots for tools, pipe rest for easier cutting and threading, 3 handy benders that won't dent pipe. Yoke or chain vise with LonGrip jaws, safe for nickeled pipe. A worksaver bargain—buy at your Supply House.

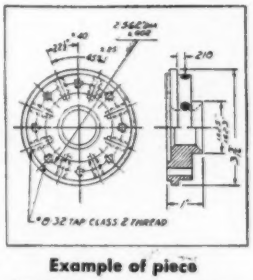
RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO



Precision Adapter for Drill Presses Perfects Alignment—Prevents Drift!

The new Aetna Adapter, of aluminum alloy, fits the columns of most small drill presses—assures accurate milling and deep hole drilling—without a drill jig. It firmly and accurately holds interchangeable drill bushings close to work.

Precision alignment is accomplished through an eccentric aligning bushing, which once set needs no further adjustment. Filler bushings cover the entire bushing range up to ½". Stops to locate the piece to be drilled, are attached to the press table or directly to the adapter. Milling chatter is avoided. Chip interference is eliminated. Overlapping holes can be drilled without punch marks, or indication of run-out, with drills as small as 1/32" diameter. ¼" holes can be drilled more than 6" deep with as little as .006" drift.



Example of piece drilled with Aetna Adapter

Accuracy in work is achieved best by alert workers. That's why many plant owners make chewing gum available to all. The chewing action helps relieve monotony—helps keep workers alert, aiding them to do a better job with more ease and safety. And they can chew Wrigley's Spearmint Gum right on the job—even when hands are busy.

You can get complete information from Aetna Mfg. Co., 250 Chicago Ave., Oak Park, Ill.

AB-60

AHEAD OF THE FIELD

Warren "Realwear" Steam Pumps

4 new standard features at no extra cost!

Yes, Molded Piston Cup Packing, Stainless Steel Durabla Valves, Stainless Steel Piston Rods and All Steel Valve Gear (Bronze Bushed), are now *standard* features on Warren Horizontal Duplex Piston Pumps—"Realwear" Type! Standardization of these features . . . in addition to the many other advantages of "Realwear" design . . . gives you a pump that is far and away the leader in its field. Here are the advantages:

WARREN MOLDED PISTON CUP PACKING

Greater efficiency and lower operating costs because of minimum slippage . . . and longer liner life because of less wear when these cups are used.

Repacking made easier.

Much longer life of cups compared to ring packing.

Successfully handles practically all liquids . . . including hot water to 250° maximum at pressures to 1000 lbs. maximum . . . with standard cups and higher temperatures and pressures with special cups.

STAINLESS STEEL DURABLA VALVES

Achieve instant adjustment to variations in load; open only enough to allow passage of the flow; close instantly; eliminate slip; reduce cavitation, turbulence, and friction losses to a minimum; and permit pumps to operate at full load at slower speeds.

STAINLESS STEEL PISTON RODS

Insure maximum resistance to corrosion and wear.

ALL-STEEL VALVE GEAR (Bronze Bushed)

Adds strength and length of life to this constantly moving and important part of the pump.

WARREN MOLDED PISTON CUP PACKING

THE DURABLA VALVE

Completely open under full load

Partially open under light load

Write for information

WARREN PUMPS

WARREN STEAM PUMP COMPANY, Inc., Warren, Mass.

For Safety and Dependability

STYLE "A"

FLEXO JOINTS

STYLE "B"

Moving feed lines—particularly those carrying steam or fluids at high temperatures or pressures—must be safe. Yet the safety of any feed line can be no greater than the safety of its flexible joint. Of four simple parts—with no small parts, no springs—no ground surfaces to wear, Flexo Joints are preferred and specified by engineers world wide.

STYLE "F"

STYLE "H"

Flexo Joints are available in four styles. Pipe sizes from "¼" to 3".

Send for illustrated folder of data and specifications.

FLEXO SUPPLY COMPANY, Inc.

4655 Page Blvd. St. Louis (13), Mo.

In Canada: S. A. ARMSTRONG, Ltd., 115 Dupont Str., Toronto 5, Ont.

● You pay a share of this tremendous loss, if you fail to protect iron and steel surfaces from the metal-consuming "fire" of rust. Yet, rust CAN be *stopped* by sealing the surface so that no oxygen can reach and oxidize it. RUST-OLEUM combats rust as effectively as water quenches fire.

For less than 1-cent per square foot you can add years of life to metal roofs, gutters, smokestacks, fire escapes, railings and fences. RUST-OLEUM will positively stop and prevent rust on all types of metal surfaces.

See your distributor or write for Catalog No. 246.

EASY TO USE . . . LASTING PROTECTION

- No expensive preparation. Merely wire brush to remove scale, dirt, etc.
- RUST-OLEUM penetrates remaining rust and incorporates it within the protective film.
- RUST-OLEUM does not crack, blister or peel.
- Excellent coverage . . . Lasts longer.
- Full selection of colors.

APPLY BY BRUSH, DIP OR SPRAY

RUST-OLEUM CORPORATION

2421 Oakton Street

EVANSTON, ILLINOIS

Boiler Tubes

ANY SIZE—BENT OR STRAIGHT

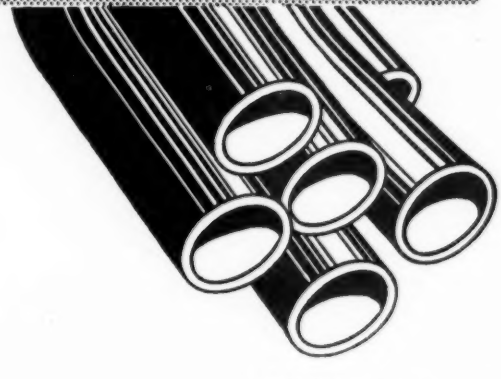
This organization has the experience and facilities to meet your most exacting requirements. We can promise quick delivery on precision work, guaranteeing accuracy as to length and bend. Why not send that next order to "Boiler Tube?"

BOILER TUBE CO. OF AMERICA

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH • CHICAGO

FRED S. RENAULD & CO., LOS ANGELES



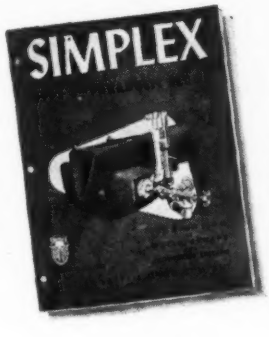
For open flow of water, sewage, industrial liquids . . .

SIMPLEX TYPE S-PARABOLIC FLUME METERS HAVE ALL THESE GREAT ADVANTAGES!

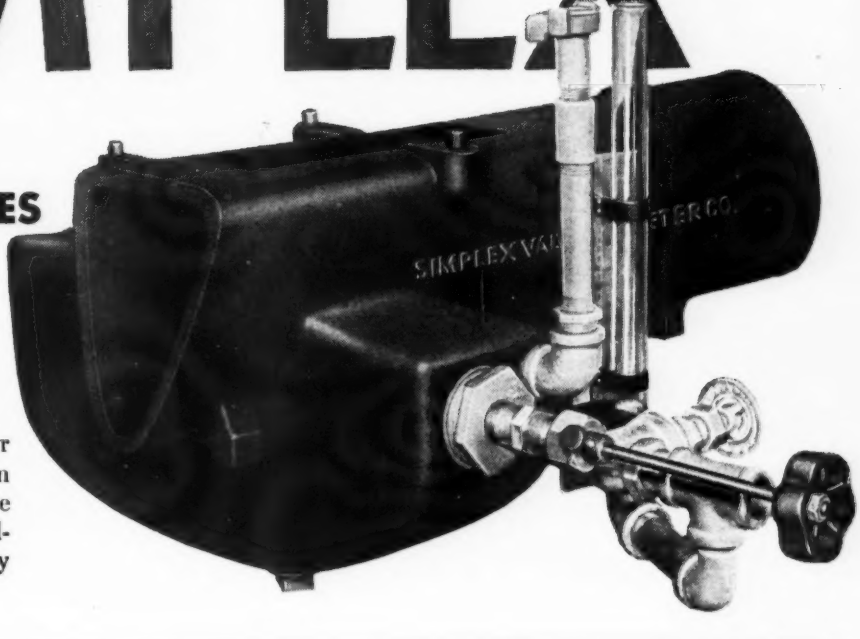
1. Compact cast iron measuring section—ready to place in the line.
2. Self-scouring design permitting passage of sediment or solids.
3. No pockets or grooves in measuring section to clog up or facilitate accumulation of matter.
4. No straight section of pipe on exact grade required upstream of flume casting.
5. Can be attached to larger pipe sizes by eccentric reducer thereby saving installation costs.
6. Operates under extreme low head and low flow conditions.
7. Small head loss—requires very little free fall at outlet.
8. Generous capacity to handle high—as well as low flows.
9. Ability to measure over long flow range—from maximum to 5% of maximum.
10. Mechanical or electrical transmission from flume to meter with indoor or outdoor installation as desired.
11. Available in sizes 6" diameter to 36" diameter inclusive.

SIMPLEX

TYPE-S PARABOLIC FLUMES

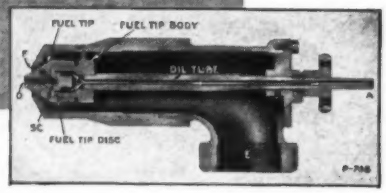


Send for your copy of Bulletin 210 — complete operation, installation, capacity data



SIMPLEX VALVE & METER COMPANY
6780 UPLAND STREET, PHILADELPHIA 42, PA.

FIRE *your*
METAL WORKING,
HEAT TREATING,
METAL MELTING
and other PROCESS
FURNACES with



NATIONAL AIROIL FUEL OIL · GAS BURNERS

TYPE
"LAP"
OIL BURNERS

Type "LAP" Oil Burners use low air pressure for atomization; operate equally well under draft or positive pressure; give long, trouble-free service (with light or heavy oil) under manual or automatic control.

They have a wide clean firing range in each of seven sizes; are of rugged construction; can be repaired quickly, with parts of the same size interchangeable; and are readily adjusted to produce a sharp, intense oxidizing flame or a soft, reducing flame.

Full information is contained in Bulletin 65.

Write for it.

NATIONAL AIROIL BURNER CO., INC.
Main Offices & Factory: 1250 EAST SEDGLEY AVENUE, PHILADELPHIA 34, PA.
Texas Office: 2nd National Bank Bldg., Houston
INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

At last!

Practical data for designing AUTOMATIC CONTROL systems

Systematic design procedures--
Test procedures--
Working formulas, curves and diagrams--

SERVOMECHANISM FUNDAMENTALS
by Henri Lauer, Robert Lesnick and Leslie E. Matson
ALL OF THE ENGINEERING DEPARTMENT, R.C.A. VICTOR DIVISION RADIO CORPORATION OF AMERICA

Here, at last, is real, practical aid in designing servomechanisms—a presentation of theory, specific design procedures and helpful test procedures, that will enable you to fulfill specified operating requirements, get the satisfaction you want from an automatic control system. The book analyzes various servo systems—those with viscous output damping, error-rate damping, integral control, etc. It presents scores of problems like those you actually encounter in servomechanism design, with the working formulas, curves and diagrams necessary for their solution.

Just published!

SERVOMECHANISM FUNDAMENTALS

By HENRI LAUER, ROBERT LESNICK and LESLIE E. MATSON

All of the Engineering Department, RCA Victor Division Radio Corporation of America

277 pages, 6 x 9, 165 figures, $3.50

This book answers the need for a sound, practical reference on servomechanisms, and provides engineers with practical assistance in solving the problems they meet in achieving smoothly operating systems. The theory is developed by means of transient-response analysis methods. Scores of detailed schematic diagrams, drawings, graphs, charts and circuit diagrams are included. Helpful test procedures for checking the performance of a servo system have been outlined.

Ten chapters cover these topics:

1. Elementary Forms of Control Systems
2. Servo System Follow-up Links
3. Fundamentals of Mechanics and Electricity
4. Analysis of Servomechanisms with Viscous Output Damping
5. Analysis of Servomechanisms with Error-rate Damping
6. Analysis of Servomechanisms with Combined Viscous Output Damping and Error-rate Damping
7. Error-rate Stabilization Networks
8. Analysis of Servomechanisms with Integral Control
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Prepared by Bridgeport Brass Company "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE, and COPPER*

Reducing Premature Failures of Condenser Tubing

With the high cost of materials and labor and the necessity for maintaining heavy operating schedules while waiting for new equipment and tubing, power plant operators must take all possible steps to increase condenser tube life. Premature failures can be reduced to a minimum by eliminating, wherever possible, factors which accelerate corrosion.

Effect of Foreign Matter

We have previously discussed protective films which develop on metal surfaces. Removal of the film, by mechanical or chemical means, exposes the metal to accelerated corrosion.

There are a number of mechanical factors which may cause premature failure of condenser tubing. For example, pieces of shells, stones, coke, coal and other foreign material lodged in condenser tubes may cause the water to be deflected against the

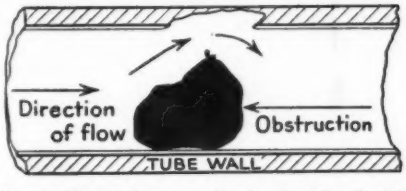

Fig. 1. Sketch shows result of a deposit of solid material which is deflecting a stream of water against the tube wall.

tube wall. (See Figure 1.) The impinging stream, with or without sand or entrained gases, may break down protective film and lead to local attack of the metal. (See February, 1947, Copper Alloy Bulletin for discussion on impingement corrosion.)

The presence of sand or entrained gases generally leads to increased attack. This type of attack is recognized by the absence of corrosion products in the pitted area.

Water carrying sand or silt, in the absence of direct impingement, described above, is quite likely to have a scouring action on the tubes. If continued over a long enough period, this may seriously reduce the wall thickness.

Effect of Dents in Tubes

Dents formed on the outside of the condenser tube wall, resulting from improper handling during shipping or installation, can lead to local failure of tubing. Water striking the bump inside the tube may cut through the protective film at that point and thin the wall locally until, eventually, perforation occurs. (See Figures 2 and 3.) The photograph shows a section of aluminum brass condenser tubing with a bump

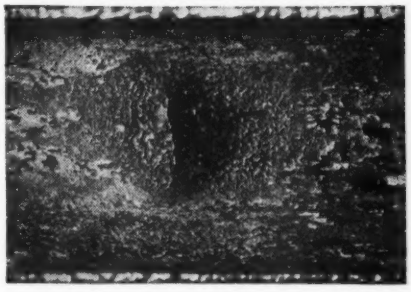

Fig. 2. Aluminum brass condenser tube which failed at point caused by dent in tube wall. Mag. 1½X.

inside the tube wall caused by a dent. Failure occurred at the bump.

Also visible is a mottled film, consisting of thin, transparent corrosion product in contact with the metal surface. There is also present a translucent film of iron compound, which was deposited by the sea water, which picked up a trace of iron from the water boxes, piping, etc. Normally, this is a very protective type of film, and since the sample showed no other failures from impingement corrosion, this is a clear case of failure caused by salt water impinging on a bump on the tube wall.

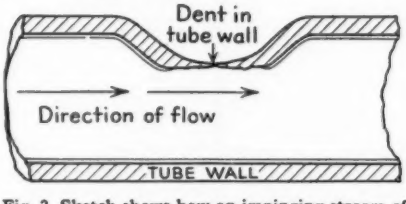

Fig. 3. Sketch shows how an impinging stream of sea water cuts down wall thickness at the bump on the inside wall.

Vibration Accelerates Corrosion Cracking

It has been shown by many investigators that vibration may lead to corrosion fatigue cracking of metals. (See Figure 4.) This suggests that protective films in condenser tubes are injured from the flexing associated with the bending of vibrating tubes. In this type of failure minute circumferential cracks, varying in number from a few up to several hundred, generally develop midway between the tube support sheets or within a few inches from the tube sheet. Deep hemispherically-shaped pits may develop in the area approximately midway between the tube supports. Visual examination of tubes which have failed from corrosion fatigue cracking may show cracks as well as corrosion pits; either may predominate.

Corrosion fatigue cracking is most prevalent in that portion of the condenser tubing exposed to the full force of incoming vapor, which, through impact on the tubes, may start them vibrating. The movement is considerable and especially damaging if the frequency of the pulsation is the same as the resonant frequency of the tubes. Also, the tubes may be roughened on the outside surface by the impact of the steam.

Still another evidence of vibration is the presence of score marks on the outside of

Fig. 4. Corrosion fatigue crack viewed from the inside surface of condenser tubing. Mag. 1½X.

the tubes. These result from tubes rubbing against one another.

Many Failures Can Be Avoided

There are certain preventive measures which can be taken to eliminate mechanical factors likely to cause premature failure of condenser tubing. In previous issues of the Bulletin a number of methods have been described for keeping condensers free from dirt and debris. Such procedures will go a long way toward increasing condenser tube life. Whatever steps can be taken to keep tubing smooth and undistorted will be beneficial to the power plant operator. By handling tubes with care at all times, dents and other injuries can be avoided.

Prevention of corrosion fatigue cracking of condenser tubing due to vibration is sometimes very troublesome. However, in many cases vibration has been stopped by the avoidance of critical operating velocities of turbines, pumps, motors, etc., as well as through the use of additional tube support plates, so that the span between the tube supports is not too great.

Select Proper Alloy

Selection of the most suitable condenser tube alloy for maximum efficiency and greatest economy, with minimum tubing failure, depends upon many factors.

Operators can benefit from Bridgeport's long experience and extensive corrosion research program. Laboratory-trained men are available for discussion of corrosion problems. Bridgeport manufactures a complete line of corrosion-resistant condenser and heat exchanger tubing. Contact the nearest Bridgeport office and write for 112-page Condenser Tube Manual, containing important information about condenser tube alloys, corrosion research, methods of installing and suggestions for increasing condenser tube life.

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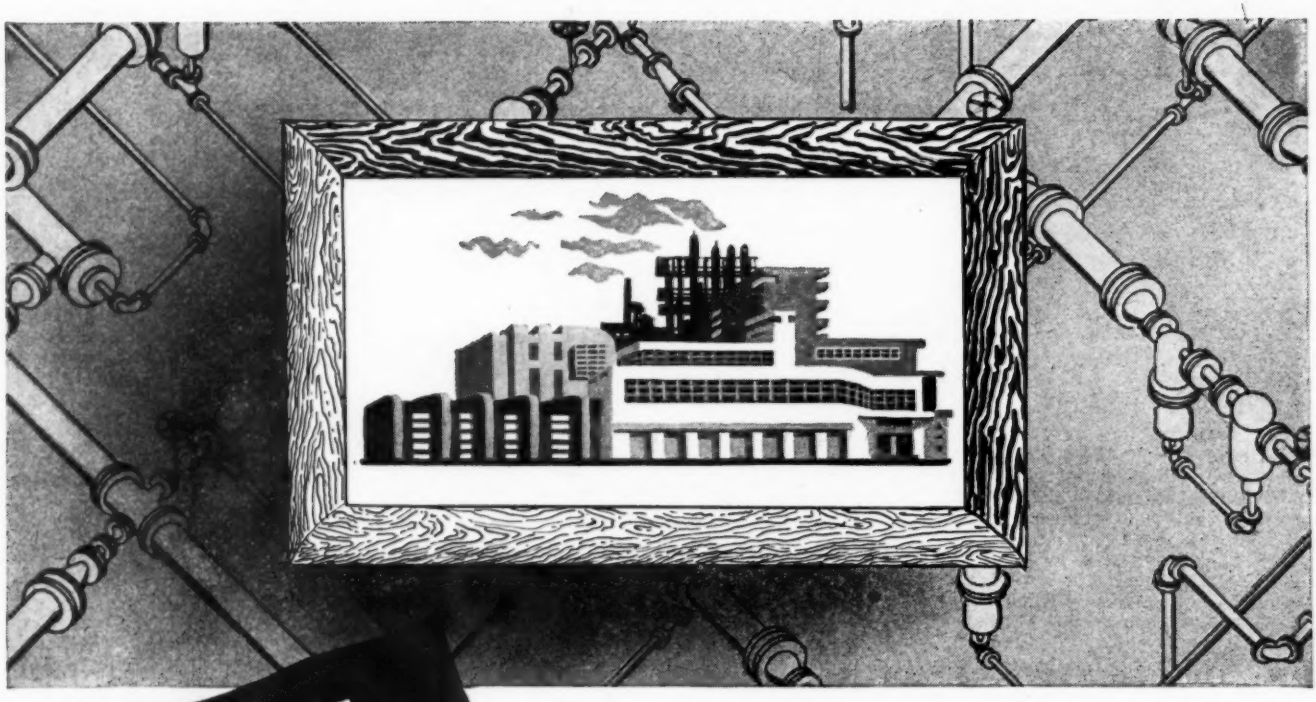

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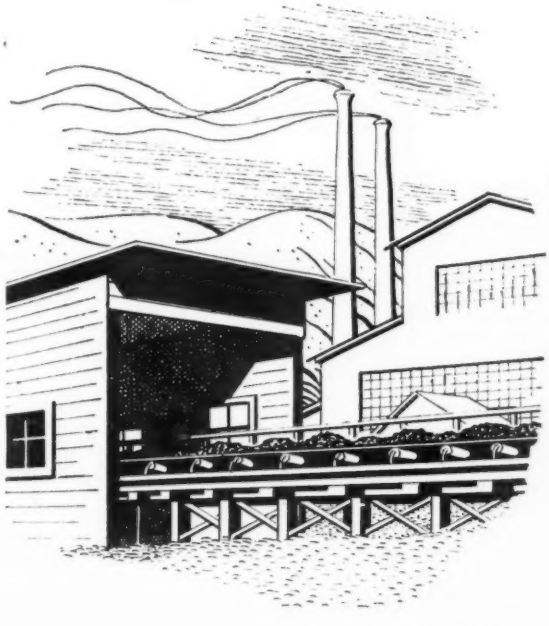

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Fig. 12

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Fig. 21 Fig. 22

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Fig. 13
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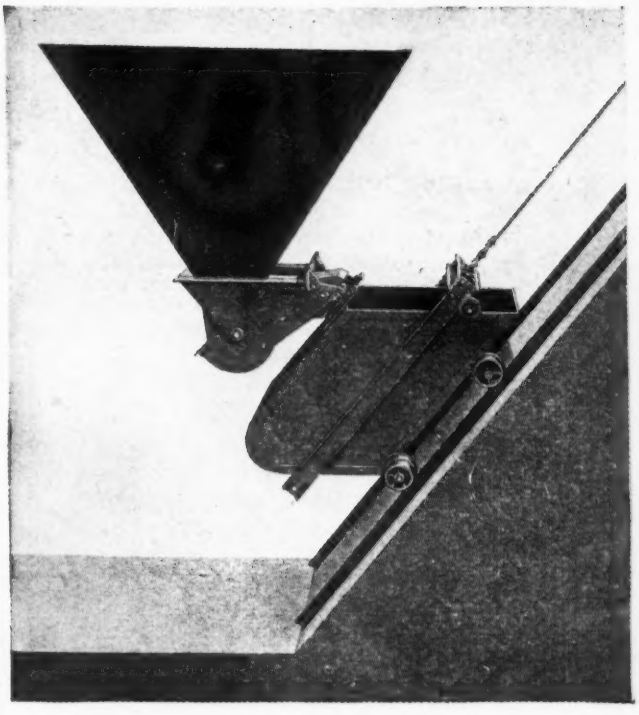

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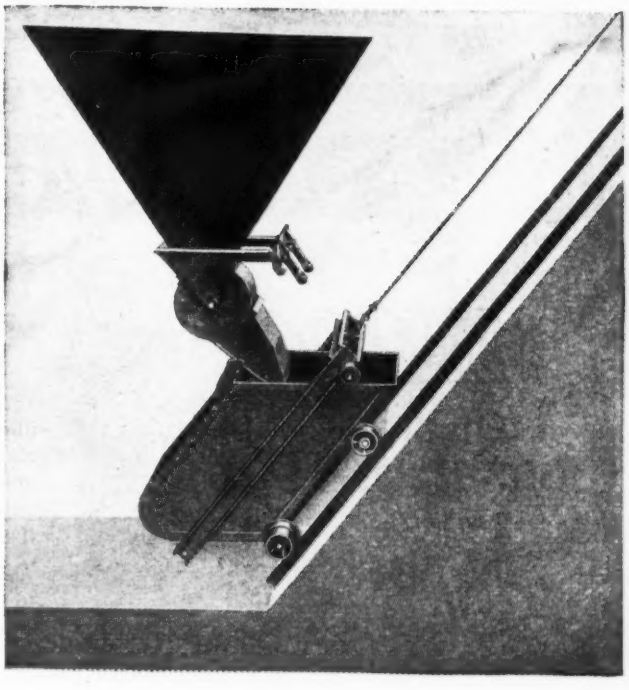

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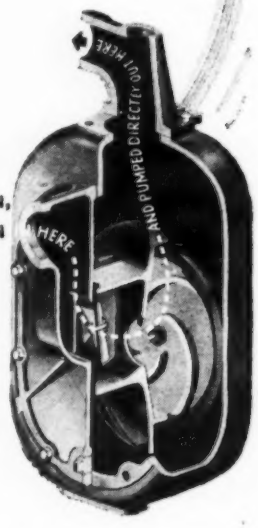

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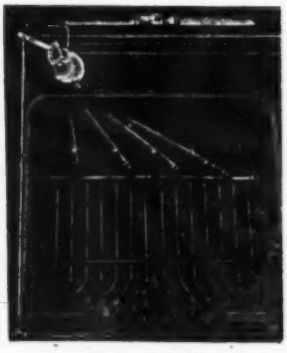

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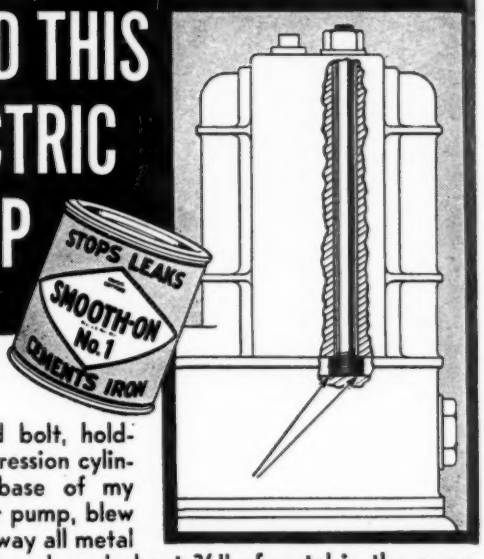

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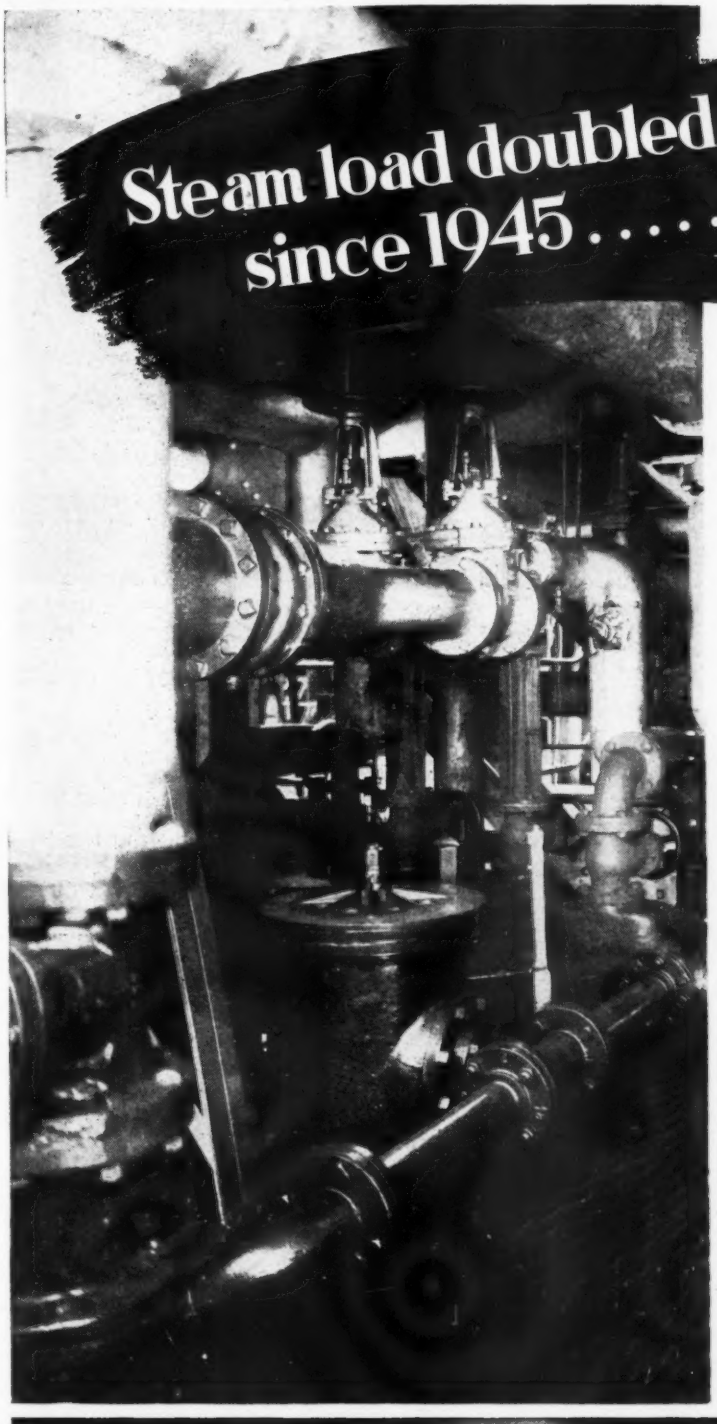

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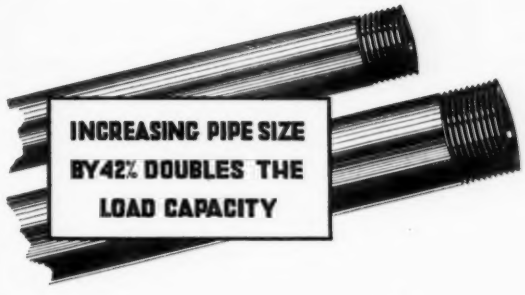

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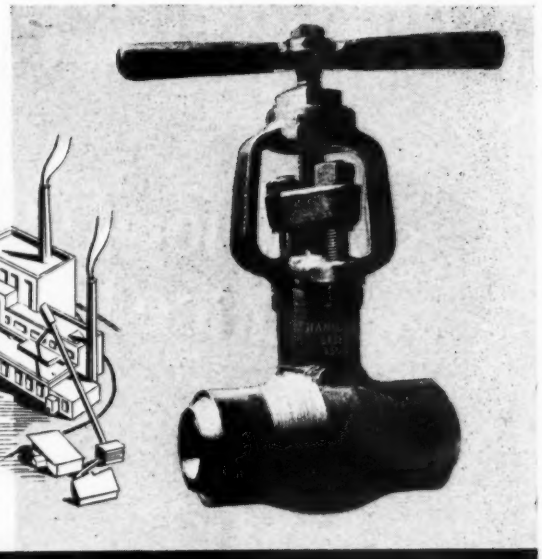

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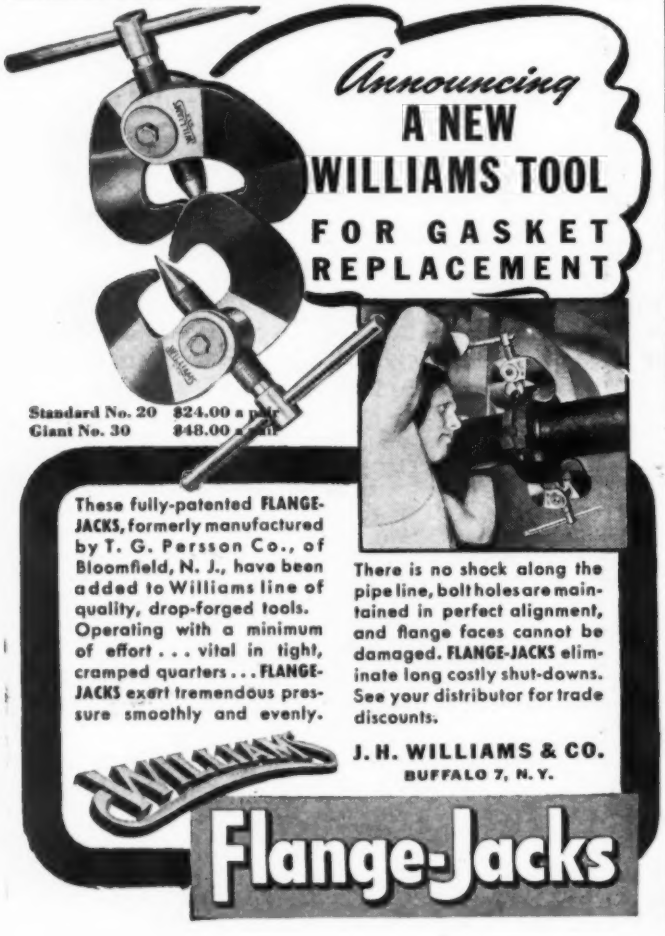

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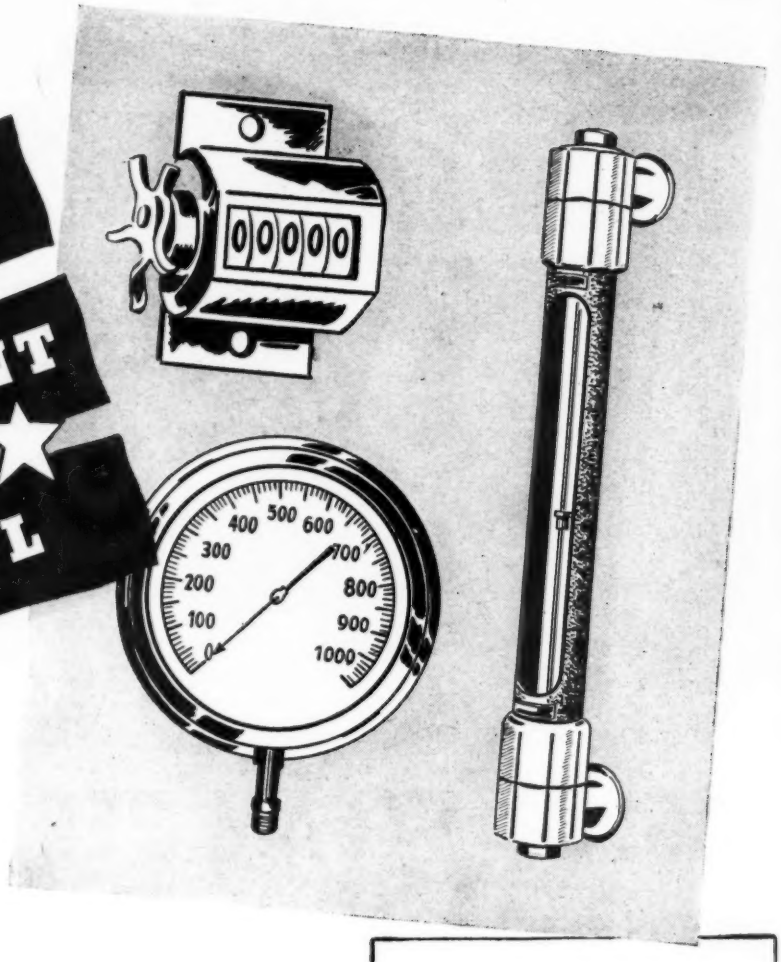

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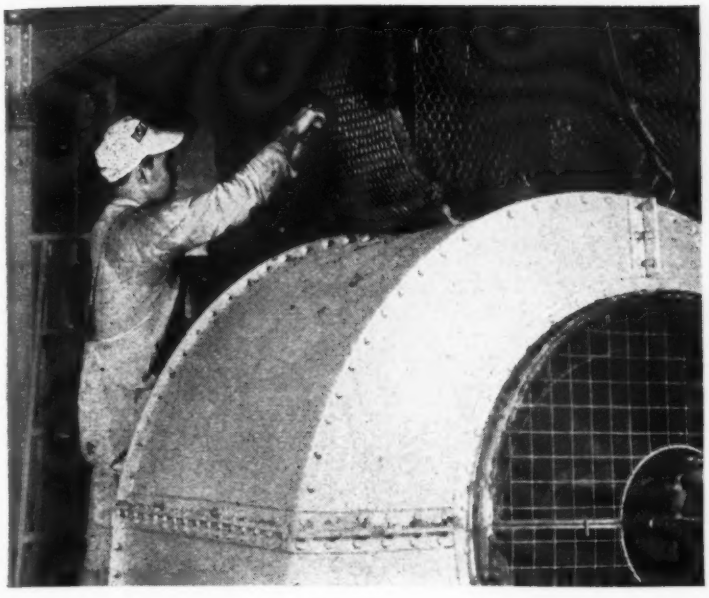


More power
to you, with
EAGLE-PICHER
Insulations

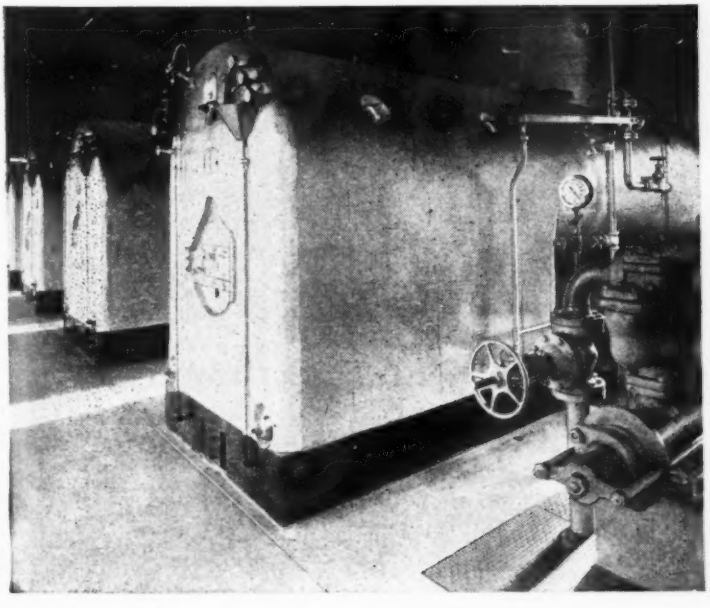
Eagle-Picher Super "66" Insulating Cement

All-purpose . . . for permanent efficiency

"Springy Ball" pellets of Eagle-Picher Mineral Wool contain thousands of minute dead air cells that give Super "66" tremendous insulating efficiency. These pellets retain their form even after the insulation dries, to preserve permanently extremely low thermal conductivity. In addition, Super "66" actively inhibits rust on metal equipment. It's all-purpose, sticks to any shape surface, and withstands temperatures up to 1800 F. Complete technical and application data on request.

Let these Eagle-Picher products also save you money . . . power . . . time

Supertemp Block • Blankets
Low Temperature Felts
Loose Wool • Stalastic • Insulseal
Pipe Covering • Insulstic
Swetchek • Finishing Cements



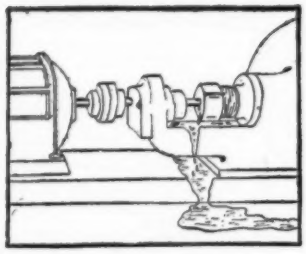
EAGLE-PICHER INSULATIONS for

EAGLE EP PICHER

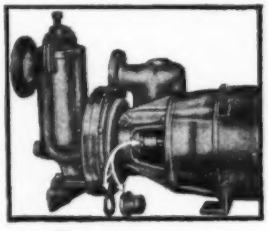
High and Low temperature

Since 1843
THE EAGLE-PICHER COMPANY
CINCINNATI (1), OHIO

TROUBLED WITH LEAKY STUFFING BOXES on Your Pumps?



Try SYNTRON MECHANICAL SHAFT SEALS the next time!

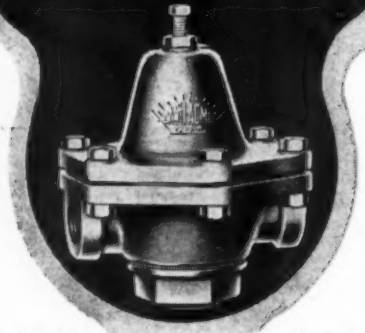


Simple and easy to install.
Self-lubricating.
Standard seals for handling clean water, refrigerant gases, oil, etc. Special seals for corrosive and abrasive liquids.

Write for illustrated catalog folder

SYNTRON CO., 492 Lexington, Homer City, Pa.

Reduce Pressure Problems



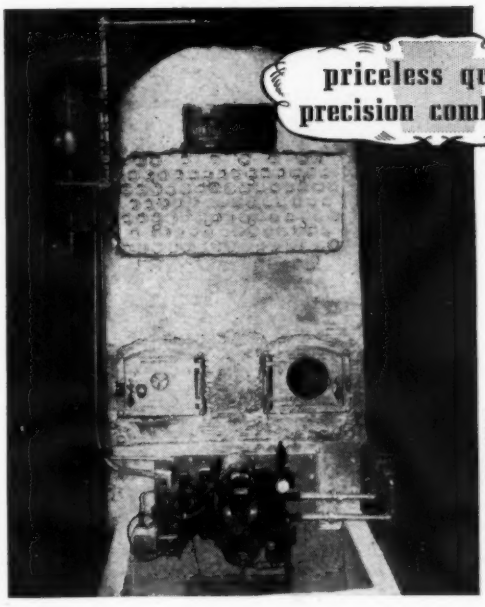
The CASH-ACME Type "B" Pressure Reducing and Regulating Valve is made to be installed and forgotten. Quality materials and workmanship have been combined to make the Type B, under normal operating conditions, give years of DEPENDABLE, TROUBLE FREE SERVICE. Available for Industrial applications on STEAM, WATER, AIR, OIL, and many other GASES & LIQUIDS in sizes ranging from ¼" to 2" inclusive.

In Automatic VALVES its THIS name that counts

★ Write today for YOUR copy of our 28 page Catalog describing how CASH-ACME products can best serve you.

CASH-ACME

A.W. CASH VALVE MFG. CORP.
6662 EAST WABASH AVE.
DECATUR ILLINOIS



Model APBD 60 h.p. belt-drive York-Shipley Industrial Burner firing heating boiler at plant of Faichney Instrument Corp., Watertown, New York.

YORK-SHIPLEY

world's most complete line of Industrial Oil Burners

Faichney Instrument Corporation . . . world's largest manufacturer of clinical fever thermometers . . . chose a *York-Shipley* Industrial Burner to solve a very definite heating problem.

This belt-drive automatic unit with standard motor (8500 EDR steam) replaced an underfeed stoker. All labor, dust, ashes, uneven building temperatures, and maintenance were eliminated. Two firemen—one of whom stayed until 10 p. m. each evening, and the other who came on at 4 a. m.—were no longer needed.

York-Shipley Industrial Burners are built in two series—belt-drive and direct-drive, with or without pumps—in sizes from 45 to 400 boiler h.p.—and burn fuel oils No. 1 through No. 6. Fully automatic units are featured. Industrial Division, York-Shipley, Inc., York, Pa.

{ Write for Catalogs ID-47-8F and ID-46-6F . . . yours on request. }

YORK-SHIPLEY

Oil-Fired Equipment for Industry

AMERICA'S MOST COMPLETE LINE
IN CANADA—SHIPLEY CO., LTD., TORONTO

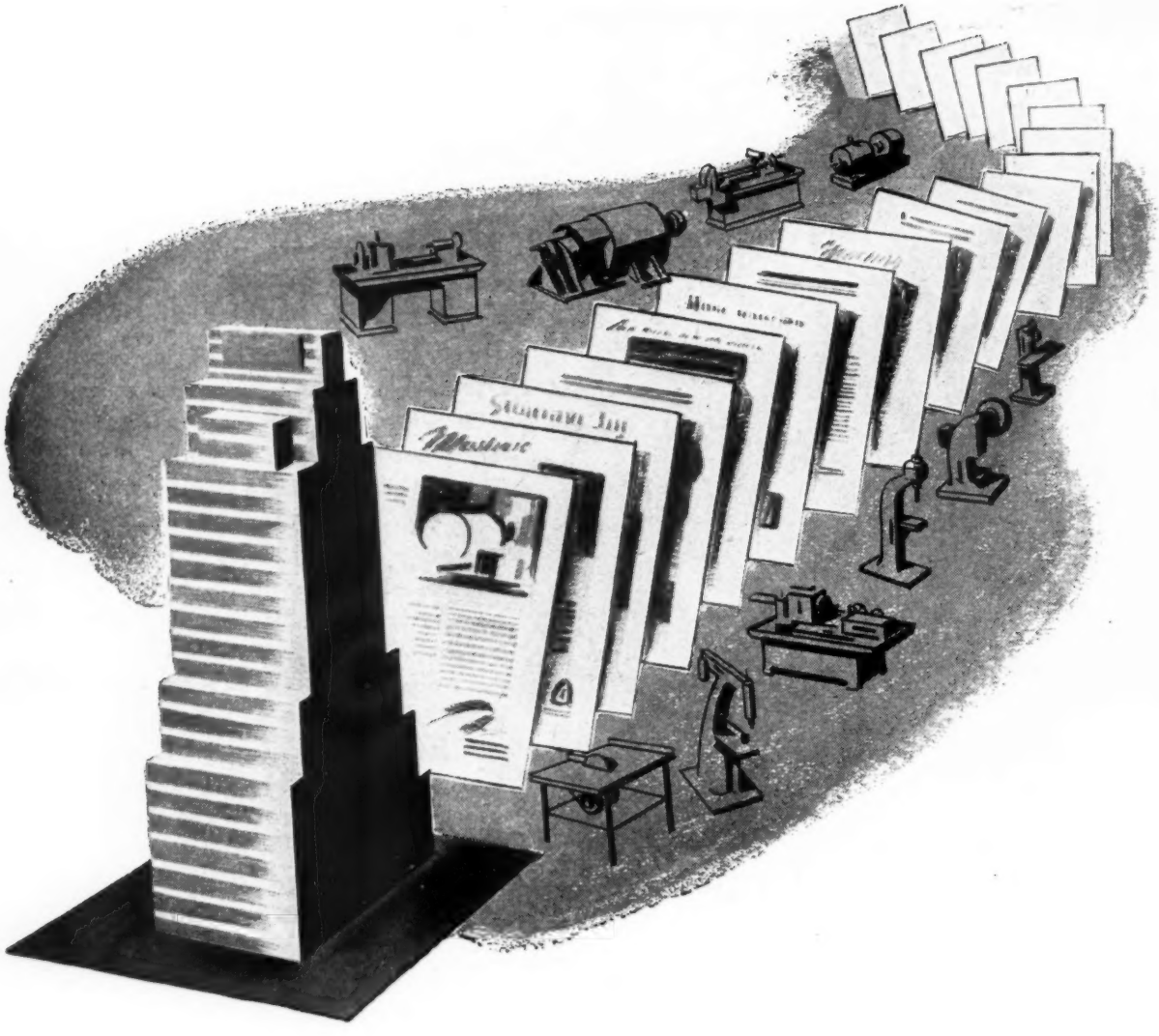
"DUAL BANK" IN TYPES FOR EVERY REQUIREMENT

Dual Bank Efficiency, which closely approaches the "theoretical ideal" in surface condensers, can be obtained in any size and in types for every installation and operating requirement. In addition to the Standard and Low Headroom Types, are the Patented Reverse Flow Type, which automatically cleans its tubes and tube sheets periodically without a drop in operating efficiency, and the Divided Water Box Type, in which half of the condenser can be shut down for maintenance while the other half operates at reduced efficiency. . . . The advantages of "dual bank" tube arrangement, with the wide central steam lane and deep penetration feeder lanes, are fully described in our 44-page Catalog No. 1461. Write for it today.

C. H. WHEELER MFG. CO.
1800 SEDGLEY AVENUE, PHILA. 32, PA.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

C. H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS



The Parade that has no End

As you go through the pages of this magazine . . . or of any other McGraw-Hill publication . . . a colorful parade of advertising pages unfolds before your eyes.

If you are like thousands of other readers of these magazines, you'll become an avid spectator of this interesting educational show. You'll take in the *whole* of this passing parade.

Why? Because this parade is a non-stop exhibition of all that's new in industry—new developments in products and services, new ways for the buyer to make use of these products, news which can often mean the difference between profit and loss to you.

That's why readers of McGraw-Hill magazines are cover-to-cover readers. That's why they're *regular* readers . . . *serious* readers. That's why men say: FOR THE FACTS OF *INDUSTRIAL* LIFE, TURN TO McGRAW-HILL.

McGRAW-HILL

Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.

The McGraw-Hill Network of Industrial Communication: American Machinist • Air Transport • Aviation • Aviation News • Bus Transportation • Business Week • Coal Age • Chemical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical Wholesaling • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • McGraw-Hill Digest • Mill Supplies • Power • Product Engineering • Science Illustrated • Textile World • The Welding Engineer.

Twin-bank design for

REDUCED HEIGHT

Four-way reversing valves for

FLEXIBLE OPERATION

are features of this new LUMMUS surface condenser

LOOK TO LUMMUS *for*

Heat Exchangers
Process Condensers
Reboilers
Steam Generators
Steam Jet Refrigeration
Steam Surface Condensers
Barometric Condensers
Steam Jet Air Ejectors
Evaporators
Boiler Blowdown Heat Exchangers
Fuel Oil Heaters
Lubricating Oil Coolers
Pipe Line Coolers
Feed Water Heaters
Jacket Water Coolers

In designing this 34,000-sq.-ft. surface condenser for a prominent utility, Lummus adapted it for low head-room installation by reducing the height of the steam dome and turbine connecting piece and widening the central steam lane—in effect, placing the hood inside. Further space savings were effected by the use of a shallow, wide bath-tub type hotwell.

Separate water boxes at both ends of each of the twin banks were provided to permit operation of one half of the condenser while the other half is "down" for cleaning.

Four-way, 30-in. motor-operated valves, designed and built by Lummus, provide for switching the waterflow. The Lummus-designed-and-built two-stage twin-element air ejector was furnished with combined type inter-and-after condenser.

Lummus designs and builds all types of surface condensers and other heat-exchange equipment. For information relative to your requirements, write The Lummus Company, 420 Lexington Avenue, New York 17, N. Y.

Lummus
HEAT EXCHANGER DIVISION

WHERE TO BUY

Featuring additional products, specialties and services for power plants

End Pump Troubles!

HILL IMPROVED PUMP VALVES

● The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.

HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO 47, ILL.

TEST SPEEDS and SAVE at a glance
REVOLUTIONS and FEET per min.
SPEED VARIATIONS
BELT CLIPPAGE
Send for Bulletin

O-Z Improved Hand Tachometer-Cutmeter
O. ZERNICKOW CO.
21 Park Row New York

FYR-FEEDER
MULTIPLE SPREADER **STOKER**
Saves Coal, Saves Labor—It's Automatic, Efficient! Pays for itself over and over again.
Write for information.
AMERICAN COAL BURNER CO.
Chicago R-11, Ill.
Since 1899—Engineers, Originators and Builders of Thousands of Industrial Grates and Stokers

This **WHERE TO BUY** *Section*

supplements other advertising in this issue with these additional announcements of products and services essential to modern power plant operation. Make a habit of checking this page, each issue.

CLASSIFIED ADVERTISING DIVISION **POWER**

PROFESSIONAL SERVICES

ASSOCIATED ENGINEERS, Inc.
Joseph C. Lewis, *President*
Management Consultants
Engineering . . Architecture . . Accounting
Organization . . Methods . . Costs
230 E. Berry St., Fort Wayne 2, Ind.

T. MASENG & ASSOCIATES, Inc.
Engineer
Electrical, Design — Structural, Reports — Mechanical Rates
7 So. Dearborn Chicago 3, Ill.

J. E. SIRRINE COMPANY
Engineers
Power Plants — Consultation
Design — Reports
Water — Steam Utilization — Plans
Greenville South Carolina

ELECTRIC CONSTRUCTION COMPANY
Engineers—Contractors
Design—Erection—Maintenance of
Power Plant, Sub Stations
Transmission and Distribution Lines
Modern Equipment
Philadelphia, Pa.

LUKE L. NAKASHIAN
Engineer
PROCESS STEAM PLANTS
POWER PLANTS
OIL REFINERY EQUIPMENT
404 Park Square Building. Boston 16, Mass.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg. Muscatine, Ia.

E. R. GARLOCK & ASSOCIATES INC.
Industrial, Mechanical & Electrical Maintenance Engineers
Complete plant and power maintenance, rehabilitation, installation, construction, inspection, performance and efficiency supervision.—Emergency repairs. High pressure power units a specialty.
201-202 Delaware Bldg. Akron 8, Ohio

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEERS
Design — Operations
Steam - Hydraulic - Gas
231 S. LaSalle St. Chicago (4), Ill.

JOHN A. STEVENS, INC.
Established 1909
CONSULTING ENGINEERS
Power Plants — Paper Mills
Dye Houses — Surveys
Lowell, Massachusetts

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Industrial and Utilities
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examinations—Laboratory
61 Broadway New York — 147 K St., N.W. Washington, D. C. — 17 & Sansom St., Phila., Pa.

REYNOLDS, SMITH AND HILLS
ENGINEERING CONSULTANTS
Specialists in Design and Construction of Industrial and Central Station Plants
Reports, Analyses and Surveys
10 South Laura St. Jacksonville, Fla.

SYSKA & HENNESSY
Engineers
Consultation — Plans — Reports
Power Plants — Disposal Plants
Water Systems
144 East 39th Street
New York, New York

HALL LABORATORIES, Inc.
R. H. HALL, Ph.D., Director
CONSULTANTS ON
BOILER WATER CONDITIONING
Hagan Building Pittsburgh (30), Pa.

SANDERSON & PORTER
ENGINEERS
AND
CONSTRUCTORS

THE J. G. WHITE ENGINEERING CORPORATION
Design - Construction - Reports - Appraisals
80 Broad Street, New York 4

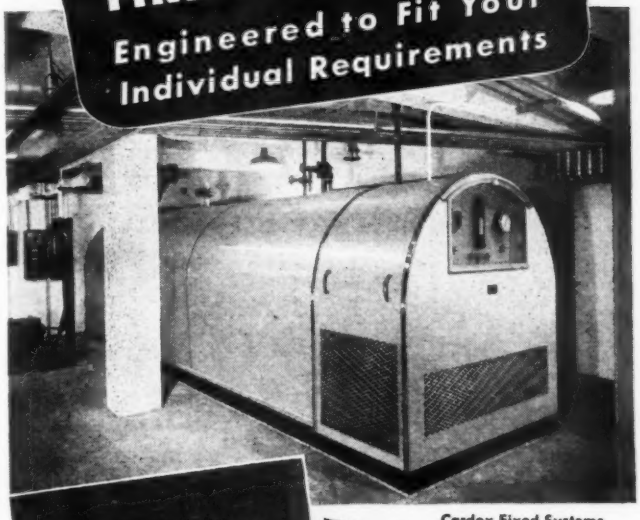
KEGARISE-CRONK ENGINEERING CORP.
Engineers - Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Steam and Electric Utilization
Design — Reports — Plans
334 E. Main St. *P. O. Box* 668 Johnson City, Tenn.

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St. Chicago, Illinois

WHITMAN, REQUARDT AND ASSOCIATES
Engineers-Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plants—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.

CARDOX FIRE PROTECTION

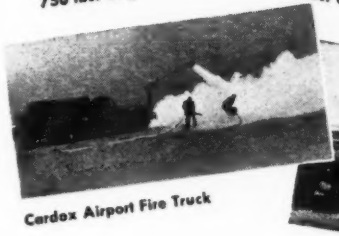
Engineered to Fit Your Individual Requirements



Cardox Fixed Systems

Cardox Transitank*
750 lbs. CO_2

Cardox Fire Trailer*
750 lbs. CO_2 . . . 32 gal. Foam solution



Cardox Airport Fire Truck

Cardox Fire Truck

Cardox engineered applications of low-pressure carbon dioxide give this fast-acting, non-damaging medium new effectiveness in conquering fires, large or small, both indoors and out.

Whether the hazard or combination of hazards calls for *500 pounds* or *125 tons* of Cardox CO_2, a single Cardox System . . . with its compactly designed, centrally located Storage Unit—can be engineered to meet the *specialized* or *varied* fire problems involved. Cardox Mobile Units for indoor or outdoor protection put wheels under 750 pounds to 3 or more tons of carbon dioxide for instant use in any part of the property.

Utilized individually or in planned combinations, Cardox Fixed Systems and Mobile Units have given new scope to all the recognized advantages of CO_2 fire protection. Write for Bulletin 957 and recommendations for Cardox engineered protection for the tough fire hazards that worry you.

*Now available in many localities

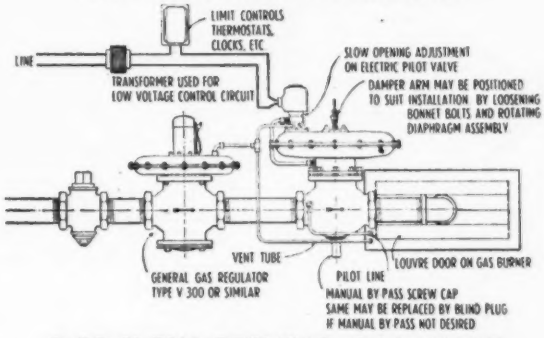
CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices: New York • Philadelphia • Pittsburgh • Cleveland
Detroit • Los Angeles • San Francisco • San Diego

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

B-55-VALVES

For efficiency, safety and economy, specify the ONE valve that answers all your requirements for industrial and commercial burners and furnaces.

Note the features in this installation


LIMIT CONTROLS THERMOSTATS, CLOCKS, ETC
LINE
TRANSFORMER USED FOR LOW VOLTAGE CONTROL CIRCUIT
SLOW OPENING ADJUSTMENT ON ELECTRIC PILOT VALVE
DAMPER ARM MAY BE POSITIONED TO SUIT INSTALLATION BY LOOSENING BONNET BOLTS AND ROTATING DIAPHRAGM ASSEMBLY
VENT TUBE
LOUVRE DOOR ON GAS BURNER
GENERAL GAS REGULATOR TYPE V 300 OR SIMILAR
PILOT LINE
MANUAL BY PASS SCREW CAP
SAME MAY BE REPLACED BY BLIND PLUG
IF MANUAL BY PASS NOT DESIRED

B-55 SLOW OPENING GAS VALVE

Adjustable opening time—5-60 seconds. Widest operating pressure range—up to 5 pounds. Widest range of sizes—¾" to 6" i.p.s., for manufactured, natural or L.P. gas. Ample power for louvre control; damper arm easily rotated to desired position. Low current consumption; sizes to 1½" i.p.s., 8 Watts—2" to 6", 14 Watts.

Contact Nearest Factory Branch, or Distributor
or write direct, for Catalog 52C

Manufacturers of Automatic Pressure, Temperature and Flow Controls

GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1, CALIF.

FACTORY BRANCHES: PHILADELPHIA • ATLANTA • BOSTON • CHICAGO • DALLAS
KANSAS CITY • NEW YORK • DENVER • DETROIT • CLEVELAND • PITTSBURGH
HOUSTON • SEATTLE • SAN FRANCISCO • DISTRIBUTORS IN PRINCIPAL CITIES

The GUESS IS OUT WHEN YOU MEASURE YOUR VALUABLE STORED LIQUIDS With LIQUIDOMETER Tank Gauges

100% AUTOMATIC

FOR GAUGING LIQUIDS OF ALL KINDS

APPROVED BY UNDERWRITERS' LABORATORIES

WRITE for COMPLETE DETAILS

"LIQUIDS WORTH STORING ARE WORTH MEASURING"

THE LIQUIDOMETER CORP.
39-16 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising)
70 cents per line, minimum 4 lines. To figure advance payment count 6 average words as a line and allow 10 words for a publication box number address.
POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.
PROPOSALS, 75 cents a line insertion.

INFORMATION:
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
This advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. P.

NEW ADVERTISEMENTS received by May 12th will appear in the June issue, subject to limitation of space available

POSITIONS VACANT
(Additional Position Vacant ads on opposite page)

ELECTRICAL ENGINEERS experienced in design of substations, power plants or overhead and underground distribution systems. Desirable living conditions in fine home community. Write to Electrical Engineer, Pennsylvania Power & Light Co., Allentown, Pa.

WANTED: MAINTENANCE Supervisor to conduct repair work in two steam electric power plants developing 200,000 KW; age 30-45; must be familiar with maintenance of turbines, oil fired boilers and auxiliary equipment; locate Southern California. Address replies to P-266, Power, 68 Post Street, San Francisco 4, Cal.

DRAFTSMEN AND Designers: Mechanical; Experienced in steam power plant layout work, piping, structural steel, etc. State age, experience and salary desired. Write P-277, Power, 520 N. Michigan Ave., Chicago 11, Ill.

GRADUATE MECHANICAL Engineer Wanted: Must be experienced in operation and management of modern steam plant, and capable of supervising operating personnel. Permanent position with well known electric utility in Northwestern Ohio. Write full particulars about age, experience, salary requirements to P-278, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED, MAN with capacity to assume charge of power plant in Mid-western paper mill. Must be licensed steam engineer, experienced in operating boiler plants, reciprocating engines and turbines. Excellent opportunity. Address P-282, Power, 520 N. Michigan Ave., Chicago 11, Ill.

POWER PLANT Inspection Engineer wanted by leading Boiler and Machinery Insurance Company. Locations: Spartanburg, South Carolina and Boston, Massachusetts. Technical graduates not over 35 preferred. Practical experience in the operation or maintenance of prime movers and electrical equipment necessary. Permanent position with good future possibilities. In reply, give age, employment record and salary expected. P-288, Power, 330 W. 42nd St., New York 18, N. Y.

SALES PROMOTION Man with practical piping or pipe fabrication experience, technical training preferred, for the sales promotion of a new type of product used in these industries. Advertiser is a manufacturer of long established reputation. Give experience, age, and salary. Full details given in first interview. P-296, Power, 330 W. 42nd St., New York 18, N. Y.

BOILERMAKER FOREMAN—Affiliated with A. F. of L. to work for one of the nation's largest construction firms. Must have experience in general tank and boiler erection. Steady employment in Eastern U. S. Give details in first letter. Write P-297, Power, 330 W. 42nd St., New York 18, N. Y.

MACHINE, LECETRICAL Designers—Excellent permanent positions for experienced men open now with large eastern Penna. manufacturer. Write details to P-298, Power, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER or Draftsman capable of designing cast steel and cast iron valves for industrial service. This is an opportunity to join the Engineering Staff of an old established Eastern New York State Valve Manufacturing Company. In reply state experience, age and salary required. Address P-299, Power, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITY OFFERED

WANTED: MECHANICAL engineer-salesman for district manager in charge our New York office. Established accounts. Must be experienced in selling pumping machinery or steam turbines. Salary and commission. Real opportunity for $10,000 a man. Give full experience history. Replies strictly confidential. Dean Hill Pump Co., 4000 E. 16th Street, Indianapolis 7, Indiana.

MECHANICAL ENGINEERS
WITH 5 TO 15 YEARS EXPERIENCE
In Design of Steam Electric Generating Stations or Gas Plants
Write to
MECHANICAL ENGINEER
PENNSYLVANIA POWER & LIGHT CO.
Allentown, Pa.

MECHANICAL ENGINEER WANTED
to head Department for long-established, outstanding engineering firm in Southern Ohio. About ten years experience in consulting work required; full knowledge of design of industrial power plants, heating, ventilating, air conditioning, refrigeration, all accessory equipment, steam and process piping. Salary open.
P-303, Power
330 West 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICES

SALARIED POSITION $2,500-$25,000. This thoroughly organized confidential service of 37 years recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000 - $25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 109 Church Street, New Haven, Conn.

POSITIONS WANTED

ENGINEER—Over 20 years experience in design and application of centrifugal pumps. Desires position with reliable firm. Available on short notice. PW-283, Power, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER, 34, graduate of Swiss university, 10 years experience including power plant electrical maintenance, design and construction. Skilful organizer. Actually electrical superintendent of important mining corporation in South America. Available July 1st. Wished executive or supervisory position with industrial corporation or utility company in Latin America. Speaks and writes excellent Spanish. PW-301, Power, 330 W. 42nd St., New York 18, N. Y.

POSITIONS WANTED

POWER PLANT Superintendent seeks wider opportunities and responsibilities. Available immediately. 20 years experience, supervision, administration, maintenance and operations, of mechanical and electrical equipment and power services including installations. 6 years with present employers, as power services superintendent. Certificated First Class Engineer, high school education, courses 1 year university. I. C. S. and I. T. A. mech. drawing. Will go anywhere. PW-304, Power, 330 W. 42nd St., New York 18, N. Y.

Additional Employment Advertising On the Opposite Page

To EMPLOYERS who advertise for MEN:

WHEN there are many applicants for a single position it frequently happens that the only letters acknowledged are those of the most promising candidates. Others may not receive any indication that their letters have even been received by a prospective employer much less given consideration. These men often become discouraged, will not respond to future advertisements, and sometimes question their bona fide character.

Every advertisement printed in the Searchlight Section is duly authorized.

It will help to keep our readers interested in this advertising if you will acknowledge every application received, even if you merely return the letters of unsuccessful applicants with, "Position filled, thank you" written or stamped on them. If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of cooperation between employers and the men replying to Positions Vacant advertisements.

★

Classified Advertising Division

McGraw-Hill Publishing Co., Inc.

★

"Put yourself in the other fellow's place."

MECHANICAL
ELECTRICAL
STRUCTURAL
ARCHITECTURAL
DESIGNERS & DRAFTSMEN

The Austin Company solicits applications from men interested in the opportunities offered by a nation-wide organization prominent in the industrial building field.

Positions are open in New York, Cleveland, Chicago and Oakland

Mechanical—Heating, air conditioning, ventilation systems, process piping, conveying systems, plumbing, sewer and sprinkler systems.

Structural—Industrial buildings and miscellaneous structures of steel and reinforced concrete.

Electrical—Industrial lighting and power distribution.

Applications should be made to one of the following offices and should give full particulars and compensation desired in first letter.

THE AUSTIN COMPANY

New York City
19 Rector St.
Whitehall 4-6393

●

Chicago, Illinois
510 No. Dearborn
Superior 6100

●

Oakland, Calif.
618 Grand Ave.
Highgate 6070

National Headquarters
16112 Euclid Avenue Cleveland, 12, Ohio
Glenville 5400

ENGINEERS
COMBUSTION CONTROL

Opportunities for engineers in combustion control field

SALES ENGINEERING
Service and Installation

DEVELOPMENT ENGINEERING

Applicants should be graduate electrical or mechanical engineers with at least 3 to 5 years' experience in stationary steam power plant engineering and/or test work, and be thoroughly familiar with boiler control and instruments.

LEEDS & NORTHRUP CO.
Personnel Dept.
4901 Stenton Ave. Phila. 44, Pa.

WANTED

ENGINEERS

Wanted by Michigan firm of engineers, men qualified for structural and mechanical design, drafting, and construction supervision on power plant work. Answer to

P-276, Power
520 North Michigan Ave., Chicago 11, Ill.

ENGINEER WANTED

PROJECT MANAGER FOR STEAM POWER PLANT DESIGN AND CONSTRUCTION

One of nation's largest engineering firms has permanent position open for seasoned executive to supervise design and construction of industrial power plants. 20 years' experience with major engineering firm and some background of sales contact work preferred. Applicant must be able to design and estimate steam power plants, contact and negotiate with customers. Salary commensurate with ability. Give full details in first letter including age, education, record of experience and earnings, salary expected, when available for interview.

P-292, Power
330 West 42nd St., New York 18, N. Y

WANTED

POWER PLANT ENGINEER

Small Paper Mill Manufacturing Co. located in the Southwest.

Man having good knowledge and experience on operation of Boiler Plant, Turbine Generator operations, and Panel Board

P-307, Power
520 North Michigan Ave., Chicago 11, Ill.

A CHANCE

For Sales Engineers who are really willing to work and can produce, there is available EXCLUSIVE TERRITORY in this Country and Abroad as Representatives of a Manufacturer offering
A COMPLETE LINE OF INDUSTRIAL OIL BURNER & AUXILIARY EQUIPMENT
Burners for all industries and processes. Power, Heat, Metallurgical, Chemical, Glass, etc.

Equipment specifically suited to each service that will out perform any burner on the market in overall efficiency and throttling range in continuous control operation.

An excellent opportunity for those wishing to combine interesting engineering with paying sales.

RW-295, Power
330 West 42nd St., New York 18, N. Y

Sales Representative
WANTED

—Power Plant Specialty
—Commission Basis
—No investment required
—MUST be a man who follows smokestacks
—STATE lines you are currently representing and the territory you cover.
—Ours is a "quality" product of long established reputation.

BIRCH MFG. COMPANY
1521 N. Sedgwick St.,
Chicago 10, Ill.

POWER SALESMAN

Splendid opportunity for advancement for man who qualifies—Midwest community—fairly concentrated territory serving 750,000 people. Applicant should be around thirty-five years of age and have at least ten years experience in power sales work. State qualifications and enclose snapshot. Replies confidential.

SW-302, Power
520 North Michigan Ave., Chicago 11, Ill.

INDUSTRIAL ENTERPRISE

● WANTED

Large financially powerful diversified organization wishes to add another enterprise to present holdings.

CASH PAID For Capital Stock or Assets

Existing personnel normally retained
STRICTLY CONFIDENTIAL

Box 1234, 1474 B'way, N. Y. 18, N. Y.

WANTED

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes

ALL TRANSFORMERS GUARANTEED FOR ONE YEAR

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"

MARIEMONT Since 1912 CINCINNATI 27, OHIO

GENERATOR WANTED

Generator — 5000 K.V.A. or larger, 3 phase, 600 volt preferred, although higher or lower voltage may be acceptable. In latter case transformers of full generator capacity, or greater, may be required, having generator primary voltage and 600 volt secondary.

Give complete information as to type and characteristics of equipment offered, also price. State when and where available.

W-310, Power
330 West 42nd St., New York 18, N. Y.

WANTED:

STEAM TURBINE GENERATOR

2000 KW
160 lb. Steam Pressure
3600 R.P.M.
480 Volts

Condenser complete with auxiliaries

W-305, Power
520 North Michigan Ave.
Chicago 11, Ill.

Cash Ready

FOR YOUR

ELECTRICAL EQUIPMENT

Electric motors, AC and DC
Compensators
Generators
Motor Generator Sets
Air and Oil Circuit Breakers
Panels
Exhaust Fans
Control Equipment

Send us list with full details

WIRE OR PHONE
P. O. Box 534

POWER EQUIPMENT CO.
373 SO GOODMAN ST., ROCHESTER 7, N. Y.
Phone Hillside 2041

WANTED

TURBO-GENERATOR

Aprox 1500 KVA 2300/3/60 180# pressure 10-20 # Extraction

Not over 15 years old

EVANS PRODUCTS COMPANY
Coos Bay, Oregon

WANTED:

SYNCHRONOUS MOTORS

HP 300 to 350
Speed 360 to 375 R. P. M.
480 Volts
3 phase—60 cycles

Together with Starting Gear

W-306, Power
520 North Michigan Ave.
Chicago 11, Ill.

WANTED

Two D.C. MOTORS

TYPE MPC, CLASS 6—150 H.P. 500. Form A, 500 R.P.M. 250 Volts, General Electric—150 H.P.

W-973, Power
330 West 42nd St., New York 18, N. Y.

Air Compressors Wanted

Horizontal Water Cooled—Any size also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

TRANSFORMERS WANTED

usable or burnt-out

IN - STOCK

1—1000 KVA-GE Single Ph.
2—750 KVA-Pittsburgh—Single Ph.
1—30 KVA-GE Constant Current

Zenith Transformer Co.
1733 N. 5th St. Phila. 22, Pa.
Poplar 5-0553

WANTED

New or nearly new 60 and 75 hp motors 900 rpm squirrel cage, 3-60-220 and across line magnetic starters.

New or used totally enclosed motor with geared vertical shaft 2 to 5 hp, 3-60-220. Preferably under 50 rpm. to use as mixer.

FARBOIL PAINT COMPANY
801 Key Highway, Baltimore 30, Maryland

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GUARANTEED GOOD BECAUSE REBUILT AND TESTED UNDER SUPERVISION OF

HEMPHILL ELECTRICAL ENGINEERS

MOTOR GENERATOR SETS

1—125 K. W. Crocker-Wheeler 125 V. Sq. Cg. 2300 V. 3 phase, 1200 RPM.
1—100 K.W. Electric Machinery, 125 volt, synchronous motor, 4150 volt, 3 phase, 1200 RPM.
1—100 K.W. General Electric, 230 volt, squirrel cage, 440 volt, 3 phase, 1200 RPM.
6—17 K.W. Allis-Chalmers 3 unit 125 V. Sq. Cg. 220 V. 1800 RPM.

ENGINE GENERATOR SETS

1—150 KVA. G.E. Ames Uniflow Engine, non-condensing.

TURBO GENERATORS

1—600 K.W. Terry dual bleeder condensing Turbine only.
1—300 K.W. General Electric, 3 phase, 60 cycle, 220 volt cond.
1—30 K.W. 125 volt Allis-Chalmers non-cond.

TRANSFORMERS

2—500 KVA. single phase, Allis-Chalmers 7800/13,800 primary, 115/230 secondary.
3—150 KVA. 3 phase, General Electric, type HT, 27,060 primary, 125/216Y secondary.
1—1000 KVA. Auto Transf. 4150 V. 3 ph. 4 wire to 2406 V. 2 PH.
3—100 KVA. Westinghouse 11430/250 volt.
2—100 KVA. General Electric 13200/250 volt.
2— 50 KVA. Pittsburgh 7500/15000 V. 110/220 v.
2— 50 KVA. Pittsburgh 4000 volt, 110/220.
20—Brand new General Electric air-cooled 440/220 volt primary, 220/110 secondary.
20—Brand new ditto only 220 volt primary, 220/110 secondary.
1—15 KVA. Pittsburgh 4000 volt, 110/220 secondary.

ALTERNATORS

1—500 K.W. 3600 RPM. 600 volt, General Electric D.C. exciter.
1—200 KVA. 3600 RPM. 240 volt, Allis-Chalmers D.C. exciter.
1—180 K.W. 514 RPM, 550 volt, Westinghouse.
1—165 K.W. 514 RPM, 2400 volt, Electric Mach.
112—KVA. type TS. General Electric, 900 RPM. 220 volt.
1—20 K.W. General Electric, ATB, 720 RPM., 2200 volt, 3 phase, 60 cycle.
1—62½ K.W. 3600 RPM, 230 volt, Allis-Chalmers.
1—40 K.W. 1800 RPM, 550 volt, General Electric.
1—35 K.W. 1200 RPM, 240 volt, Columbia Electric D.C. exciter.
1—31.3 KVA. 1200 RPM. 120/280 volt, American D.C. exciter.
1—12.5 KVA. 1200 RPM. 240 volt, Westinghouse, D.C. exciter.

MOTORS—VARIABLE SPEED
230 VOLT

2—200 H.P. 425/212 RPM. General Electric MPC.
1— 40 H.P. 755/1000 RPM. Sprague LC.
1— 30 H.P. 400-120 RPM. General Electric RC 204.
1— 25 H.P. 650/2200 RPM. Westinghouse SK1110L.
1— 25 H.P. 500/1500 RPM. General Electric RF-12.
1— 25 H.P. 400/1200 RPM. Westinghouse SK.
2— 25 H.P. 300/900 RPM. Electro Dynamic.
1— 15 H.P. 300/1200 RPM. General Electric RLC-2024
1—13/18 H.P. 350/1200 RPM. Electro Dynamic.
3—11½ H.P. 500/1500 RPM. Westinghouse.
1—7½/10 H.P. 500/1500 RPM. Reliance.
1—6/7.5 H.P. 450/1800 RPM. Crocker Wheeler CMC.
1—5 H.P. 500/1500 RPM. Reliance.
1—5 H.P. 600/1200 RPM. General Electric LC.
1—5 H.P. 450/1800 RPM. Crocker-Wheeler CM.
1—5 H.P. 400/1600 RPM. Diehl K6.
1—5 H.P. 225/900 RPM. Electro-Dynamic.

MOTORS 3 PHASE 60 CYCLE
SLIP RING

1—500 H.P. 900 RPM, Lincoln 440 volt.
1— 40 H.P. 1150 RPM. Cont. Electric SA85 220 volt.
1— 40 H.P. 1130 RPM. General Electric Mt. 2200 volt.

MOTORS 3 PHASE 60 CYCLE
SQUIRREL CAGE

2—450 H.P. 900 RPM. Ridgway, 2200 volt, 3 phase, 60 cycle.
2—50 H.P. 900 RPM. Fairbanks-Morse H. 220 volt.

SPECIAL

1—2000 ampere oil circuit breaker, 15,000 volt FK-130-24A—3 pole solenoid operated.

D. C. GENERATORS

1—75 K.W. 250 V., Westinghouse 260 RPM.
1—50 K.W. 115 V., Westinghouse 1200 RPM.
2—31.2 K.W. 125 V. Westinghouse 1400 RPM.
2—20 K.W. 50 V. G.E. 1800 RPM.

MOTORS D. C.
230 VOLT

2—450 H.P. General Electric MPL 250 volt, 400 RPM.
1—250 H.P. 750 RPM. Electro Dynamic 230 volt.
1—125 H.P. 1725 RPM. General Electric RC-230 volt.
1— 75 H.P. 575 RPM. General Electric C230 volt.
2— 50 H.P. 700 RPM. Crocker-Wheeler CM 230 volt.
1— 30 H.P. 1100 RPM General Electric RC-12 230 volt.
1— 30 H.P. 625 RPM. General Electric C 230 volt.
1— 25 H.P. 600 RPM. Westinghouse SK 230 volt.
1— 20 H.P. 800 RPM. General Electric RC 12 230 volt.
1— 15 H.P. 350 RPM. Diehl G-322 230 volt.

SYNCHRONOUS MOTORS

1—75 H.P. 180 RPM. Electric Machinery, 2200 V. 3 phase, 60 cycle.
1—500 KVA. G.E. 900 RPM. ATI 4150 V. D.C. exciter.
2—160 H.P. Elec. Mach. 1800 RPM. 220 V. D.C. exciter
1—100 H.P. G.E. type TS, 600 RPM. 440 volt D.C. Exciter.
1—75 H.P. 1200 RPM. ATI 220 V. 3 phase.
1—50 H.P. G.E. 1800 RPM. ATI 220 V. D.C. exciter.
1—35 KVA. G.E. 1200 RPM. ATI 2200 V. D.C. exciter.
1—20 H.P. Westinghouse 1800 RPM. 220 V. .8 P.F.

FREQUENCY CHANGERS

1—7½ K.W. 15 KVA. 50% P.F. 1800 RPM. 215 V. 270 Cy. C.W. Westinghouse.
2—15 K.W. G.E. Type MM. 270 cy.

VERTICAL MOTORS

1—75 G.E. Vert. Solid Shaft 1200 RPM. 220 S.R.
1—60 Westinghouse Solid Shaft 900 RPM. 2200 S.R.

MISCELLLANEOUS

2—2100 Gallon Pumps Dayton-Dowd 100 foot head.

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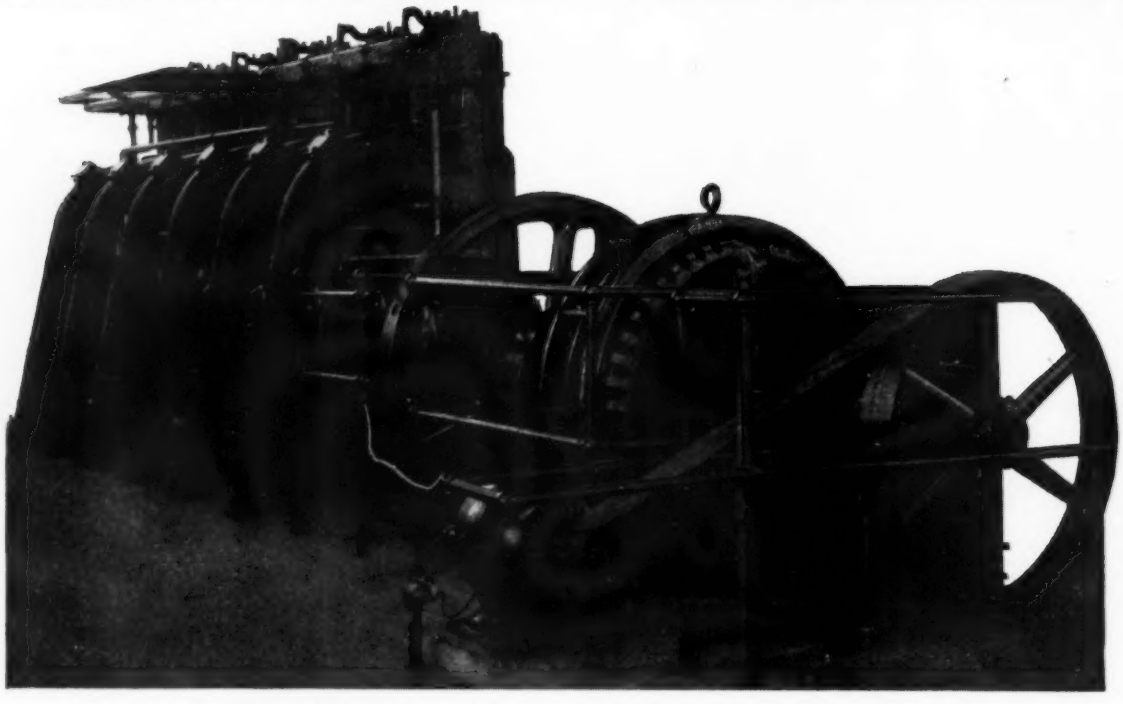
POWER PLANT MACHINERY



250 KVA FAIRBANKS MORSE DIESEL ENGINE GENERATOR UNIT

250 KVA Fairbanks Morse alternating current generator 3 phase 60 cycle 2300 volts 257 RPM direct connected to 300 HP Fairbanks Morse full diesel oil engine, 6 cylinders, type Y, style VA, model 32, 257 RPM.

Excellent condition. Can be shown in operation.

CONDENSING TURBO UNITS
3 phase 60 cycle

12500 KVA G.E. 2400 volts 275# steam
5000 KVA G.E. 2300 volts 200# steam
3750 KVA Wstgh. 4160 volts 200# steam
3125 KVA Wstgh. 2300 volts 200# steam
2500 KVA G.E. 2300 volts 200# steam
2500 KVA G.E. 600 volts 150# steam
1875 KVA Allis 480 volts 175# steam
1563 KVA Allis 2300 volts 200# steam
1250 KVA (2) G.E. 480 volts 150# steam
937 KVA G.E. 2300 volts 150# steam
750 KVA G.E. 2300 volts 210# steam
625 KVA Wstgh. 2300 volts 250# steam

EXTRACTION TURBO UNITS
3 phase 60 cycle

7500 KVA G.E. 13800 volts 400# steam, 135-165# extraction
3750 KVA Wstgh. 2300 volts 150# steam, 10# extraction
1250 KVA Allis 480 volts 250# steam, 25# extraction
940 KVA Wstgh. 600 volts 150# steam, 20# extraction
625 KVA Wstgh. 480 volts 250# steam, 25# extraction

BOILERS

90,000 lbs/hr Combustion Engineering 550 lbs. steam, 700 deg. T.T., pulverizing,
37,500 lbs/hr Heine 400 lbs. steam, 620 deg. T.T., oil burner
30,000 lbs/hr B&W 425 lbs. steam, 600 deg. T.T., pulverizing

NONCONDENSING TURBO UNITS
3 phase 60 cycle

1875 KVA G.E. 2300 volts 200# steam, 10# exhaust
1250 KVA Terry 6600 volts 300# steam, 20# exhaust
937 KVA Wstgh. 480 volts 400# steam, 60# exhaust
937 KVA Moore 2300 volts 175# steam, 20# exhaust
875 KVA Moore 2300 volts 300# steam, 100# extraction, 5# exhaust
750 KVA G.E. 480 volts 115# steam, 5# exhaust
625 KVA Wstgh. 480 volts 225# steam, 10# exhaust
625 KVA Wstgh. 2400 volts 450# steam, 50# exhaust
375 KVA G.E. 480 volts 150# steam, 20# exhaust
250 KVA Wstgh. 600 volts, 150# steam, 15# exhaust
187 KVA G.E. 480 volts, 250# steam, 15# exhaust

MOTOR GENERATOR SETS
3 phase 60 cycle

300 KW Ridgeway, 250 volts D.C., 2200 volts, A.C.,
200 KW C.W. 125 volts D.C., 2300 volts A.C.

ROTARY CONVERTERS
3 phase 60 cycle—600 volts D.C.

1500 KW G.E., 12000 volts A.C.
1000 KW G.E., 33000 volts A.C.

UNIFLOW UNITS
3 phase 60 cycle

750 KVA Nordberg, 2300/480 volts 200# steam, 15# exhaust
560 KVA Skinner, 480 volts, 150# steam, 20# exhaust
375 KVA Skinner, 2300 volts, 150# steam, 5# exhaust
375 KVA Skinner, 480 volts, 150# steam, 10# exhaust
375 KVA (2) Skinner (vertical) 240 volts, 150# steam, 5# exhaust

DIESEL UNITS
3 phase 60 cycle

1250 KVA (2) Fairbanks Morse, 2300/480 volts 720 RPM
1000 KVA (3) Hamilton, 2300/4000 volts 600 RPM
625 KVA Fulton, 480 Volts, 164 RPM
500 KVA (2) McIntosh-Seymour, 2300 volts, 164 RPM
250 KVA Fairbanks Morse, 2300 volts, 257 RPM
156 KVA Fairbanks Morse, 240 volts, 300 RPM

GENERATORS
3 phase 60 cycle

2000 KVA G.E. 480 volts 300 RPM
920 KVA E.M. 2400 volts 327 RPM
625 KVA Wstgh. 2400 volts 720 RPM
538 KVA E.M. 2400 volts 327 RPM
125 KVA Wstgh. 2400 volts 327 RPM

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone Main 9514** **CLEVELAND 14, OHIO**

BELYEA—*always follows the old-fashioned rule:*

"SUCCESSFUL OPERATION GUARANTEED"

FULL VALUE FOR YOUR MONEY IN

RE-NU-BILT ELECTRICAL EQUIPMENT REBUILT BY SPECIALISTS

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1000 KW Al. Ch. 450 V. d.c. to 1250 Kva 2300 V. Syn. Motor.
1—600 KW G.E. 3 unit with 2-300 KW 250 v. Gens. d.c. to 850 HP, 2300 v.
1—500 KW West. 120/240 v. d.c. to 700 HP, 440 v.
1—500 KW G.E. 600 V. d.c. to 700 HP—2300 V.
1—400 KW G.E. 3 Unit with (2) 200 KW 125 V. d.c. to 600 HP—2300 v. Syn.
1—375 KW—Whse 125 V. d.c. to 600 HP 2300/4000 V. Syn.
1—300 KW G.E. 550 V. d.c. to 435 HP—2300/4000 Syn. with exciter.
1—250 KW G.E. 275 V. d.c. to 350 Kva 2300/4000 Syn. with exciter.
1—250 KD Al. Ch. 250 V. d.c. to 340 Kva—2300 V.
1—200 KW G.E. 250 V. d.c. to 300 HP—2300 V. Syn.
1—150 KW whse 250 V. d.c. to 270 Kva. 440 V. Syn. with exciter.
1—150 KW whse 600 V. d.c. to 225 HP—2300 V.
1—75 KW G.E. 125 V. d.c. to 120 HP—4000/2300 V. Ind.
2—48 KW G.E. 3 unit with (2) 24 KW, 60 V. gens. d.c. to 75 HP, 440 V. Ind.
1—35 KVA whse 240 V., 3 ph. 60 cy. a.c. gen with 35 HP—230 V. d.c. motor.
1—26.4 KW W. E. 33 V. gen d.c. to 41.5 H.P.—220 V. Ind.
1—19.8 KW W. E. 33 V. gen d.c. to 32 HP—220 V.

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 B/g. Consisting of—1400 HP—4400 V. 3 ph. 25 Cy. Motor and 1000 KW—2300 V—2 ph. 58.3 cycle gen. with exciter (Gen. Can be reconnected for 800 KW 3 ph.)

1—840 KW—GE—2 unit with 2 exciters consisting of 1700 HP—2300 V. 3 ph. 25 cycle motor and 1200 Kva.—.7 pf. 2400 V. 3 ph. 60 cycle gen.

1—600 KW—Whse. 2 Unit with 2 exciters consisting of: 910 HP—200 V—3 ph. 25 cycle motor and 750 Kva.—.8 pf., 2300 V—3 ph. 60 cy. gen.

1—600 KW—GE—2 Unit Consisting of 850 HP—2300 V—3 ph. 25 Cycle Motor and 750 Kva.—.8 pf.—2300 V—3 phase—62½ cycle generator.

ROTARY CONVERRTERS

60 cycle

KW	Make	Speed	Volts	Volts
1—1500	Whse.	720	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	Whse.	1200	600	13200

TURBO-GENERATOR SETS

1—5000 KVA G.E. 2300 V. 3 ph. 60 cy. with G.E. 435 lb. Condensing turbine.
1—3000 KW whse 3750 Kva. 2300 V. 3 ph. 60 cy with Parsons 200 lb. Cond. turbine.
1—3000 KW G.E. 3750 Kva. 2300 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
1—2500 KW G.E. 3125 Kva. 600 V. 3 ph. 60 cy. with 200 lb.; 15 lb. auto extraction turbine.
1—2000 KW G.E. 6600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—2000 KW G.E. 3125 Kva. 480 V. 3 ph. 60 cy. with 175/200 lb.; 25 lb. auto extraction.
1—1500 KW G.E. 1875 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb. Cond. turbine.
2—1250 KW G.E. 1560 Kva. 2300 V. 3 ph. 60 cy. with G.E. 175/200 lb. Condensing turbine.
1—1250 KW G.E. 600 V. 3 ph. 60 cy. with G.E. 175 lb. Cond. turbine and d.c. exciter.
1—1250 KW Al. Ch. 1560 Kva. 2300 V. 3 ph. 60 cy. with 200 lb. Condensing turbine.
1—1000 KW G.E. 1250 Kva—2300 V.—3 ph. 60 cy. with G.E. 125 lb. and 16 lb. mixed pressure Condensing turbine.
2—1000 KW G.E. 1250 Kva—2300/4100 V. 3 ph. 60 cy. with G.E. 135/175 lb. Cond. turbine.
1—500 KW G.E. 625 Kva—240/480 V. 3 ph 60 cy. with G.E. 200 lb. Cond. turbine.
1—500 KW whse 625 Kva 440 V. 3 ph. 60 cy. with Parsons 145/175 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 80/100 lb. Cond. turbine.
1—300 KW G.E. 375 Kva. 480 V. 3 ph. 60 cy. with G.E. 200 lb., 10 lb. back pressure turbine.
1—300 KW whse 375 Kva. 480 V. 3 ph. 60 cy. with whse 250 lb., 5 lb. back pressure turbine.
1—300 KW Al. Ch. 120/240 V. d.c. geared to whse 440 lb. Cond. turbine.
1—200 KW G.E. 600 V. 3 ph. 60 cy. with 150 lb. non-cond. turbine and exciter.
1—125 Kva G.E. 2300 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
1—100 Kva whse 2400 V. 3 ph. 60 cy. with 125/200 lb. Non-Cond. turbine.
1—100 KW G.E. 600 V. 3 ph. 60 cy. with 200 lb. non-cond. turbine and exciter.
1—75 KW Ridgeway 250 V. d.c. with Terry 180 lb., 12 lb back pressure turbine.
1—50 KW N. W. 220 V. 3 ph. 60 cy. with 100 lb., 15 back pressure turbine.

SPECIAL

1—2000 Amp. 3 PST. 15,000 V. Sol. operated, conduit, type, F-12—15 D. OCB.—1,000,000 KVA, Interrupting capacity. Unused.

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—2100	G.E.	ATI	2300/4600	514
2— 600	Al. Ch.		2300	720
2— 350	G.E.	TS	2200	150
1— 300	Whse.		600	600
1— 200	El. Mach.		440	900

SLIP RING

1—2500	G.E.	MT	6600	253
1—1000	Whse.	CW	2300	705
1— 800	Whse.	CW	6600	443
1— 750	Whse.	CW	2200	327
1— 450	Cr. Wh.	SR-310	2300	392
1— 350	G.E.	MT-442Y	2200/4000	253
1— 250	G.E.	MT-424Y	4000	257
1— 225	G.E.	IM-17	550	705
1— 100	Al. Ch.	ANY	220	435
1— 75	F.M.	BY	2200	1750
3— 50	Whse.	CI	220	870

SQUIRREL CAGE

1—250	G.E.	IK	440	600
1—250	Al. Ch.	AN	220	1160
1—200	Al. Ch.	AN	2300	1160
1—200	Al. Ch.	IK	2300	1175
1—200	G.E.	IK	440	900
2—150/70	G.E.	IK	440	1170/870
1—100	G.E.	IK (Vert.)	2300	450
3—100	G.E.	IK	2200	600

SPECIAL MERCURY ARC RECTIFIERS

1—750 Kw—GE—Type RHW—6 Anode 575 V. D.C. Form C with 2300 V. 60 Cycle transformer and switching equipment.
1—500 KW—GE—Type RHW—6 anode 575 V. D.C. Form B with 2300 V. 60 Cycle transformer and switching equipment.

D. C. MOTORS

HP	Make	Type	Volts	Speed
2—800/1000	Whse.		450	600/720
1—800	G.E.	MPC	600	600
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
2—350	G.E.	MPC	250	450
1—335	Whse.	MQ	250	300/900
1—300	G.E.	DMC	230	400/600
1—300	Cr. Wh.	CCM-151H	230	630/700
1—300	G.E.	MPC	230	275/550
1—250	G.E.	MPC	230	400/500
1—150	G.E.	MPC	230	250/450
1—130	Cr. Wh.	CMC-51H	550	1200
2—125	G.E.	CO-1832	230	625
1—125	Whse.		240	240/600
1— 75	Rel.	385T	230	1330/1760
2— 75	Cr. Wh.	CMC	230	1150/1760

D. C. GENERATORS

KW	Make	Type	Volts	Speed
1—1200	Al. Ch.	MHC	525	750
1— 500	G.E.	MPC	600	720
1— 300	G.E.	MPC	250	525
1— 155	G.E.	MPC	250	720
1— 150	G.E.	MPC	125	200
2— 100	Whse.		240	250

39th BELYEA YEAR

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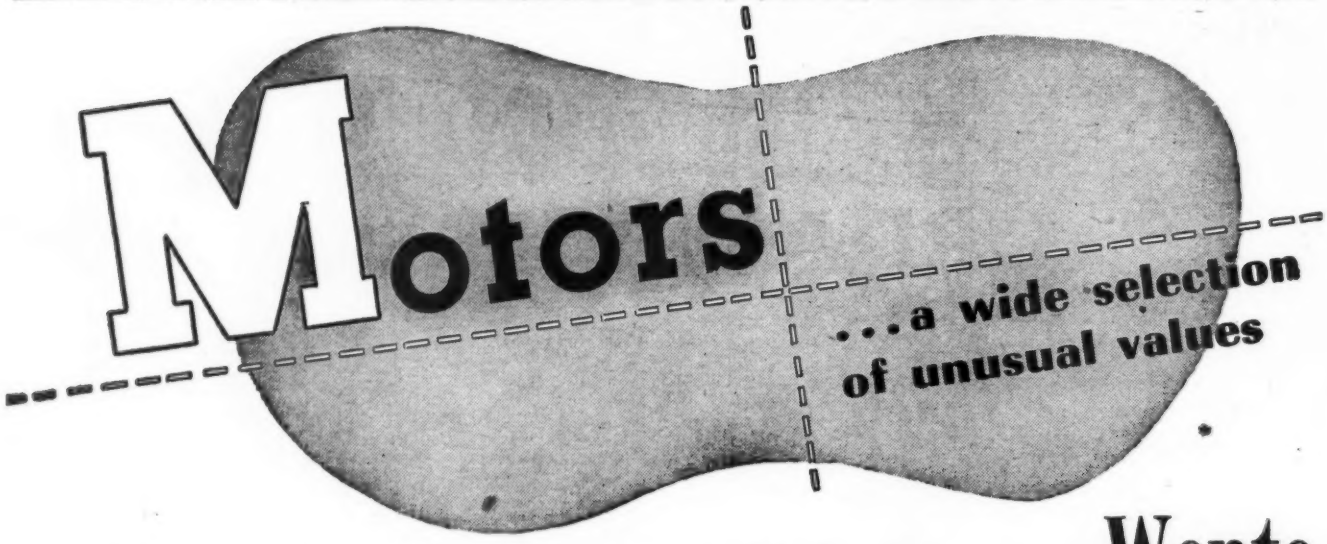

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE

3 Phase, 60 Cycle, 220/440 Volt.

Qu.	HP	Make	Type	Speed
1	300	G.E. 440v.	ATI 1800 RPM Syn.	
1	250	G.E. 440v.	KF 3600 RPM Vert.	
1	150	Al. Ch.		1750
2	125	Cr. Wh.	125Q	430 RPM
1	150	G.E.	I–550V	380 RPM
1	100	West. 2200v.	CCL	1720
1	100	G.E.	I	340
1	100	G.E.	I	290
1	100	G.E. 440v.	PCS	375 RPM
1	75	G.E.	I	575 RPM
1	50	G.E. 2200v.	I–K	900 RPM
1	50	G.E.	I	720
2	50	West.	MS 25 cy.	720
1	50	Wag.	BM	495
1	50	Al. Ch.		490
1	40	West. 220cy.	CS	870 RPM
1	40	G.E.	KT542	720 RPM
2	35	Al. Ch.	2 hp.	865
2	35	Al. Ch.		865
1	35	Ft. Wayne	2 ph.	900
1	35	G.E.	25 cy.	730
1	30	Cr. Wh.		860 RPM
1	30	Al. Ch. 2200v.		690 RPM
1	30	F.M. 2200v.	HD12B	3600
1	30	Al. Ch.		1200
1	30	Louis A.	KH	1170
1	30	West.	CCL	900
2	30	Al. Ch.	An 2 ph.	860
1	30	Century	AS 25 cy.	720
1	25	Howell		1200
1	25	Lincoln		900
1	25	Al. Ch.		860
1	25	Al. Ch.		720
1	25	G.E.	M10	720
1	25	Burke	EM	900 RPM
1	20	F. M.	KRV	1200
1	20	Clev.	M–147	900
1	20	Al. Ch.		860
3	20	U.S.	SC splash proof, ball bearing	1800 RPM
1	20	West.	CS	1750 RPM
1	20	G.E. 2200v.	I	900 RPM
2	20	(New West	220/440v. CS404, 1200 RPM	
1	18	West.	MS–4 (Elev.)	720
1	15	West.	CCL	1700
1	15	G.E.	KT	1750 RPM
1	5	Star	8B 3 (totally enclosed ball bearing)	1200 RPM
1	½	G.E.	KT	1800 RPM
2	15	West.	CS–573 25 cy.	725
2	15	West.	MS 25 cy.	725
1	15	West.	CS567C 25 cy.	715
1	15	West.	MS 25 cy.	600
1	10	West.	CS 25 cy.	725
1	10	West.	MS 25 cy.	720
2	10	West.	CS473C 25 cy.	615

SLIP RING

3 Phase, 60 Cycle, & Syn.

Qu.	HP	Make	Type	Speed
1	443	El. Mach.		900 Syn
1	200	F.M.	BV	600
2	75	F.M. 2200v.	BV–H16B	1800
1	50	Triumph	C12	1150
1	50	Ideal 2200v.	AV	575
1	50	G.E.	1M 25 cy.	700
1	50	Al. Ch.		690
1	50	West. 220v.	CW752	690 RPM
1	50	West.	CW752C	900 RPM
2	40	G.E.	MT336	1200
1	40	Al. Ch.		1160
1	40	W'g 2200v.	CW	870
1	40	Westg.	CW–658–A	870
2	40	Al. Ch.		870
1	40	Westg.	C1753A 25 cy. cr.	730
10	35/15	G.E.	OMT336	1150/550
1	35	Al. Ch.	25 cy.	720
2	35	G.E.	IM	570
1	30	F.M.	AD Alt.	1200
1	22	G.E.	ITC5011 (hoist)	680
1	25	Cr. Wh.	CW	690 RPM
1	25	Cr. Wh.		1155 RPM
1	25	Westg.	MW322A	680
1	25	G.E.	MT342	600
1	25	G.E.	MT356	400
1	20	Triumph	C10	1200
2	15	G.E.	MT302	1200
1	15	G.E.	MT332	720
1	15	G.E.	MT512	900 RPM
1	15	G.E.	MT556	280
3	10	Westg.	CW464A	1200
1	10	Westg.	HF	1140
6	2	G.E.	MT926 slip ring	1800

DC—230 Volt

Qu.	HP	Make	Type	Speed
1	75	Diehl	K11	550
1	100	G.E.	CD123	1200
1	60	Westg. 115v.	SK140L Vert.	1140
1	60	G.E.	EFI	1200
1	40	Rel. 440v.	13LT Vert.	1750
1	40	Rel. 440v.	230T Vert.	1130
1	25/40	C.W. 440v.	CMC–EH Vert.	1150/1750
1	40	Westg.	SK 123	1150
3	40	G.E.	RC32	1100
8	40	Westg.	SK 140	775
1	35	Al. Ch.		1200
1	35	G.E.	DLC 203	700
1	30	El. Dy.	158	625
1	30	Rel. 440v.	131 T Vert.	1150
4	30	Reliance	92 TF	1750
1	27½	G.E.	CVC 116	1750
7	25	Westg.	SK 120	825
2	25	Westg.	SK 103	1150
1	25	Westg.	SK 90	1400
4	25	Westg.	SK 100 L	1150
1	30	G.E.	RC 51B	1150
1	25	Westg.	SK 123 550/1100	
1	25	Al. Ch.	E 120 500/1500	
1	25	J. & L.		625
2	20	Reliance	131T	1000
2	20	Diehl	K914–A 500/1500	
1	20	G.E.	RF12 250/1000	
1	20	Lincoln	FKW B.B.	1800
6	20	Cr. Wh.	CMC T.E.B.B.	1750
1	20	Cr. Wh.	CMC T.E.B.B.	1150
1	20	Westg.	SK93	1150
14	20	Reliance	92T	1150
1	20	Westg.	SK 120 T.E.	1100
3	20	Westg.	SK 100L	900
1	20	Watson	K	850
3	20	Reliance	131T	850
1	20	G.E.	RC30	750
1	20	Westg.	SK110L–115V	750

DC—230 Volt

Qu.	HP	Make	Type	Speed
4	20	Westg.	SK110L	750
1	20	Cr. Wh.	CW–CMC	600
1	20	Westg.	SK–120	500
3	20	Al. Ch.	K	500/100
2	15	Westg.	SK63	1750
1	15	Westg.	SK113 encl.	1750
1	15	Westg.	SK93	1150
4	15	Westg.	SK83	1150
4	15	Cr. Wh.	CW–CCM T.E.	1150
1	15	Westg.	SK70L	1250
1	15	G.E.	CD83	1150
1	15	G.E.	RC10	1150
1	15	G.E.	RC29	1150
4	15	Westg.	SK93	850
4	15	Reliance	92TF	850
4	15	R. & M.		1000
1	15	G.E.	CVC–115	925
6	15	Westg.	SK90 Vert.	825
1	15	G.E.	RC29	750
6	15	Westg.	SK110L	675
1	15	Al. Ch.		1075
8	15	Reliance	131T	550
3	15	Reliance	92T	850 1750
3	15	Reliance	92T	850/1700
1	15	Reliance	66T	800/1600
1	15	Westg.	SK	500/1500
2	15	Westg.	SK110L	400/1600
1	15	Triumph	32F	300/600
1	15	Triumph		225/900
1	12½	Westg.	SK.	750/1500
7	10	Westg.	SK70	850
2	10	G.E.	RC29	850
2	10	Reliance	66TF	850
20	10	Westg. SK60L–SK60–Reliance 46TF		1150
7	10	Cr. Wh.	CM CHB T.E.B.B.	1750
1	10	G.E.	RF11	600/2400
3	10	G.E.	RF10	600/1800
6	10	Westg.	SK80L	500/1500

DC—230 Volt

Qu.	HP	Make	Type	R.P.M.
23	10	Al. Ch.		500/1000
1	10	G.E.	RF10	840/1200
2	10	Kimble	BA324 new B.B.	1750
1	10	Westg.	SK91	250/1000
15	7½	Westg.	SK33	1750
16	7½	Westg.	SK43	1150
20	7½	Westg.	SK60	850
20	5	Westg. & G.E.		1750
20	5	Westg. Rel.		1150
35	5	Westg.	SK43	580
50	3½	Westg.	SK33	850
50	3	Westg.	CD925	1725
70	3	Westg.	SK20	1650
60	1	Westg.	SK & CD	1150
50	2	Westg.	SK20	850
40	1½	Westg.	CD	1150
30	1½	Westg.	CD925	550/2200

36 New vertical TEFC BB 3 phase, 220/440 volt, 60 cycle, as follows:
1—G. E. 2 HP—1200 RPM—ty. K, Frame 225
1—Fairbanks Morse 3 HP, 1200 RPM, Type QZCU, Frame 254
1—Delco 3 HP 1200 RPM, Type C Frame 254
3—G. E. 3 HP—1200 RPM—ty. K Frame 254
1—General Electric, 5 HP, 1800 RPM, Type K Frame 254
8—General Electric, 7½ HP, 1200 RPM, Type K Frame 324
7—Delco, 7½ HP, 1200 RPM, Type C Frame 324
1—Howell, 7½ HP, 1200 RPM, Type K, Frame 324
2—Howell, 7½ HP, 1800 RPM, Type KV Frame 284
2—Delco 10 HP, 1200 RPM, Type C Frame 326
1—Delco 15 HP, 1200 RPM, Type CL Frame 365
6—G. E. 15 HP—1200 RPM—ty. K, Frame 365
2—Howell, 15 HP 1200 RPM, Type KV, Frame 365

6—New General Electric Synchronous Motors Type T.S. 200 H.P. 300 RPM, 2200 volt .8 p.f. Complete with control & separate motor generator exciter set.
1—150 KW Westinghouse, synchronous M-G set, 275 Volt DC, 4400 Volt AC, 3 ph., 60 cycle, 900 RPM, AC control and DC panel.
1—150 KW General Electric, M-G set, 250/275 Volt, DC—440 Volt AC—3 phase, 60 cycle, 900 RPM.
2—Ridgeway 100 KW. Synchronous M-G sets, 250 volt DC, 2300 volt AC, 3 ph., 60 cycle, 1200 RPM, AC controls and DC panel.
1—Burke 200 KW, synchronous M-G sets, 260 volts DC, 440 volts AC, 3 ph., 60 cycle, 900 RPM, with AC and DC controls.

1—New G. E. 250 HP, ty. KF, fr. K 549A., 440 V., 3 Ph., 60 Cy., 3600 RPM vert. direct connected to Bingham, type 2, 22 stage double case, 3600 RPM, 3820 head, 175 GPM pump.

The **Wente** *Electric Co.*

Hamilton, Ohio

Rebuilt Motors & Generators
SINCE 1906

SINCE 1910—EQUIPMENT THAT PERFORMS!

1 YEAR GUARANTEE

125 V. - 250 V. - 550 V. D.C. GENERATORS (Motor Driven and Belted)

KW	Make	Voltage	Ampere	Speed
300	Al. Ch.	250/125	1200	1200
250	G.E.	125	2000	690
200	G.E.	125V	1600	900
200	Cr. Wh.	550	363	900
150	G.E.	250	600	580
150	G.E.	125	1200	1200
150	West	250	600	1150
125	G.E.	125	1000	1150
100	G.E.	250	400	900
100	G.E.	125	800	730
100	G.E.	125	800	1150
100	Delco	250/125	400	1150
75	Cr. Wh.	125	600	1150
60	G.E.	125	480	900
60	G.E. (4)	250/125	200	1150
40	G.E. (8)	250	160	1150
40	Century	125	320	1450
40	West.	250/125	160	1500
40	G.E.	250	160	800
25	Allen	110	320	500
30	G.E. (3)	250	120	1750
20	Delco	125	160	1200
20	West. (6)	125	120	1200
20	Col. (3)	125	160	1750
20	G.E.	125	160	400
15	West.	125	120	1750
15	Roth	125	120	900
15	West.	230	60	1450
15	G.E.	125	120	1150
15	Scott	110	136	500
15	G.E. (3)	125	120	850
12½	F.M.	125	100	1450
10	Rogers (2)	125	80	1450
10	El. Dy.	125	80	600
8	G.E. (2)	125	64	1800
7½	G.E.	125	60	1800
5	G.E. (2)	125	40	1740
5	Rel.	250	20	1725

80—Additional generators—125 V. up to 200 V. generators in stock.

LOW VOLTAGE D.C. GENERATORS

KW	Make	Voltage	Ampere	Speed
1-6/1:	Hertner	80	20	1800
75	G.E.	75	1000	1145
22½	West.	75	300	720
24	G.E.	60	400	1800
1-1/8	G.E.	60	19	1800
3	Hertner	60	60	1730
40	G.E. (6)	50	800	1160
3/4	H.C.	46	11½	1750
8½	G.E.	42	205	1800
5	Diehl	40	125	1750
33	G.E.	33	1000	850
6½	G.E.	32	205	1800
2½	Witte	32	75	1800
3	G.E.	30	100	1200
	West.	30	1600	600
6	Star (2)	25	250	1800
5	Star	25	200	1750
15	Rel.	24	625	1450
4	Star	20	200	1800
1	G.E.	20	15	1800
106	El. Pr.	18	6000	
		36	3000	600
1	West.	16	60	1750
22½	Star	15	1500	1200
15	G.E.	15	1000	1200

LOW VOLTAGE DC GENERATORS (Cont.)

KW	Make	Voltage	Ampere	Speed
11	Star	15	750	1200
1	Cont. (2)	15	67	1750
4½	Star	15	300	1800
30	Columbia	8-16	5000/2500	720
12	H.V.W.	12/24	1000/500	900

300—Additional low voltage generators in stock.

(4) 600 H. P.
Westinghouse Synchronous
Motors—900 RPM
3 ph. 60 cy. 2300 Volt

Motor Generator
Set Exciter

Manual Reduced
Voltage Starting Equipment

3 Years old — Like new

230 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	125	West.	SK	825
1	100	West.	SK-180	625
1	100	Rel.		475/635
3	100	Rel.	1050T	400/1200
1	75	West.	SK	475
1	75	Cr. Wh.	New	480/670
3	60	West.	SK-160	680
1	60	G.E.	C	480/1100
1	50	West.	CK-9	525
1	45	Diehl	K-10	850
2	40	G.E.	DLC-25	1050
8	40	G.E.	CD1441	250/1500
1	40	Cr. Wh.	CCM	700
1	35	G.E.	RLC-204	440/800
2	35	West.	SK-160	400
1	30	G.E.	RC-32	1100
1	30	West.	S-6	1025
1	30	West.	SA	975
2	30	West.	SA	500/1500
1	25	El. Dyn.	10-S	1500
2	25	G.E.	RC-31	1150
1	25	West.	SK	1100
1	25	Rel.	92T	1150
1	25	West.	SK	900
1	25	G.E.	LC	900
1	25	Al. Ch.		850
4	25	G.E.	RF-12	500/1500
1	25	West.	SK	500/1500
1	25	G.E.	RF-11	500/1000
2	25	G.E.	RF-14	300/1200
1	25	G.E.	RF-14	300/900
1	25	West.	SA	325/975
2	20	West.	S	1300
1	20	R. & M.		1160
1	20	G.E.	CD-85	1150
1	20	G.E.	RC-11	1150
1	20	West.	SK-103	1200
1	20	West.	S-6	975
2	20	West.	SK-83	850
1	20	G.E.	RC	800
1	20	Al. Ch.	Series	625
1	20	West.	HY-6	700
1	20	G.E.	RF-11	500/1500
10	20	G.E.	RF-12	400/1200
2	20	Star	SHB-30	29.2

230 V. D.C. MOTORS (Cont.)

Qu.	H.P.	Make	Type	Speed
2	16/25	Cr. Wh.	35-JA	400/1200
1	15	Roch.		3450
1	15	West.	SK-63	1750
4	15	Star	SQ-1520	1200
1	15	G.E.	RC	1200
1	15	West.	SK-80L	1100
1	15	G.E.	RC-29	1150
1	15	G.E.	RC-10	1150
1	15	G.E.	CDC-85	900
1	15	West.	SK	850
1	15	G.E.	CDE-83	850
2	15	G.E.	RC-30	850
2	15	G.E.	D	700
1	15	West.	SK	675/1350
1	15	G.E.	CQ	625
1	15	El. Dy.	5S	600/1200
1	15	G.E.	CQ	600/1500
1	15	G.E.	LC	675/1150
2	15	West.	SK-100L	600/1500
1	15	G.E.	RF-11	400/1600
1	15	West.	SK	250/1100
1	15	Diehl		200/247
1	10	R. & N.		1300
1	10	West.	S	1325
1	10	G.E.	CD-75	1150
1	13	National series		1100
1	10	G.E.	RC	1100
1	10	Triumph	TR-108	860
1	10	G.E.	RC-29	850
1	10	Diehl	LS-14	750
1	10	West.	SK-7L	700
2	10	G.E.	CVC	700
1	10	Cr. Wh.	CSM	675
1	10	West.	SK	600/1200
2	10	G.E.	RLC	500/1500
1	10	G.E.	RF-10	400/1600
1	10	West.	SA	400/1200
1	10	G.E.	RF-10	400/1200
1	10	Rel.	131T	250/1000
1	7½	Sturt		3600
1	7½	L.A.	284	1750
1	7½	El. Dy.	2S	1750
5	7½	Cr. Wh.	New	1750
2	7½	Rel.	235	1750
1	7½	G.E.	RC	1700
1	7½	West.	SK	1800
2	7½	Cr. Wh.	CCM	1425
3	7½	West.	SK	1100
1	7½	G.E.	RC	1100
1	7½	G.E.	CO-1804	1200/3200
1	7½	West.	SA	975
2	7½	West.	SK-50	975
1	7½	Cr. Wh.	SM	910
1	7½	G.E.	RC	900
1	7½	Cr. Wh.	CCM	875
2	7½	G.E.	RC	850
1	7½	West.	SK-60	850
1	8½	West.	SK-30	825
1	7½	G.E.	RF-10	600/1500
1	7½	West.	SK-90	650/1300
1	7½	El. Dy.	3S	550/1650
2	7½	L. A.	BW-15	525/1150
1	7½	Roth	RS-107	450/900
1	7½	West.	SK-70	400/1600
1	7½	West.	SA	400/1600
1	7½	G.E.	RLC	400/1600
1	7½	Al. Ch.		350/1050
1	5	Star	SB-5	1750
1	5	Rel.	T-254	1750
2	5	West.	SK-20	1800
2	5	G.E.	RC	1700
1	5	G.E.	CDV	1750
1	5	West.	SK-23	1750
1	5	G.E.	CVC	1650

230 V. D.C. MOTORS (Cont.)

Qu.	H.P.	Make	Type	Speed
4	5	G.E.	CVC	1100
1	5	G.E.	CD-65	1150
1	5	Rel.	32T	1150
8	5	G.E.	RC-27A	1150
2	5	West.	SK-43	1150
1	5	G.E.	B-284	1150
3	5	Cr. Wh.	CCM	950
1	5	West.	SK-23	920
1	5	West.	SC-3	870/1750
1	5	Rel.	23T	850/1700
1	5	Al. Ch.	E-75	850
1	5	G.E.	RC	600
1	5	Cont.	D-49	600/1800
1	5	Star	SB-10	600/1200
1	5	El. Dy.	3-S	550/1650
2	5	West.	SK-60	500/1500
1	5	Cr. Wh.	CM	400
2	3	G.E.	BD-235	3600

800—Smaller D.C. motors in stock including fractional.

110 V. D.C. MOTORS

Qu.	H.P.	Make	Type	Speed
1	60	Star	SQ-60L	1200
1	25	Star	15-L	2400
1	25	G.E.	CDM-95	1000
1	20	G.E.	CD-83	1750
1	16	Cr. Wh.	CMC-L	1750
1	15	West.		1150
1	15	El. Dy.	7½ S	615/1230
1	15	West.	S	560
4	10	Lincoln		3500
1	10	L. A.		3500
1	10	Al. Ch.	EBC-75	2175
1	10	G.E.	CD-73	1750
1	10	West.	SK-70L	850
1	10	Cont.		825
1	10	Rel.		400/1600
1	10	Diehl.		230
1	7½	I.G.E.		1300
1	7½	Cr. Wh.		1700
1	7½	Al. Ch.		1350
1	7½	West.	S	975
1	7½	G.E.	CVC	825
1	7½	El. Dy.	5 S	450/900
2	7½	Broomfield		1725
1	7½	West.	SK-294	84
1	7½	El. Dyn.	5S	600/1200
1	5	Kimble	BA-225	3500
1	5	Marathon		3500
1	5	West.	SK	1750
1	5	Diehl	DP-8	1750
1	5	West.	SK	1200
1	5	G.E.	CVC	1100
1	5	Burke	AB-5	1200
1	5/10	El. Dy.		300/1800
1	6	Burke	WAB-14	650
1	5	Cr. Wh.	CMC	600/1800
1	5	Imperial	D-35	500/750
1	5	Rel.		450/1800
1	5	West.	SK-70L	500
1	5	Watson	MW-15	350
1	5	El. Dy.	7½ S	280
1	5	Diehl		247
1	3	G.E.	RC	2100
1	3	F.M.	LA225	1200
1	3	Cont.	D-31	1150
1	3-3/4	Cr. Wh.		690
1	3	G.E.	CD-73	600/1600
1	3	Cr. Wh.	CMC	535/1050
1	3½	West.	SK	450/1800
1	3	El. Dy.	3S	450

600—Smaller size 110 V. D.C. motors including fractional horsepower motors also in stock.

SEND US YOUR INQUIRIES FOR A.C. EQUIPMENT

L. J. LAND, INC.

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938 KVA AUTOMATIC BLEEDER CONDENSING TURBINE-GENERATOR UNIT

Actual Photograph

AVAILABLE
Immediate Delivery

938 KVA—750 KW 80% P.F., Allis - Chalmers 3 phase, 60 cycle, 2300 volts, 3600 RPM alternating current generator direct connected to a 750 KW, 3600 RPM Murray automatic bleeder condensing turbine 200 to 300 lbs. ISP, 500°TT, 10 to 20 lbs. gauge extraction pressure complete and equipped with surface condenser, condensing auxiliaries, exciter, switchboard and instruments. EXCELLENT CONDITION — A COMPLETE INSTALLATION.

TURBINE-GENERATOR UNITS
3 Phase, 60 Cycle

2500 KVA Allis automatic extraction condensing, 200 to 300 lbs. pressure, 2300/600 volts, 3600 RPM with exciter, condenser, switchboard.

2500 KVA G.E. condensing, 150 to 200 lbs. pressure, 2300 or 550 volts, 1800 RPM complete surface condenser.

2500 KVA Westinghouse condensing, 180 lbs. pressure, 2300 volts, 3600 RPM, complete surface condenser, exciter.

1875 KVA Westinghouse condensing, 175 to 200 lbs. pressure, 500° TT, 480 volts, 3600 RPM, complete.

750 KVA G.E. condensing, 225 lbs. pressure, 2300 volts, 3600 RPM complete shaft exciter, surface condenser, switchboard.

625 KVA G.E. condensing, 200 lbs. pressure, 2300 volts, 3600 RPM complete exciter, condenser, switchboard.

625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM, complete exciter, switchboard.

375 KVA G.E. condensing, 150 to 200 lbs. pressure, 100° SH, 2300 volts, 3600 RPM, complete with surface condenser.

125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, switchboard.

125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

ENGINE-GENERATOR UNITS
Alternating Current
3 Phase, 60 Cycle

500 KVA Westinghouse, 460 volts, 164 RPM generator direct connected to 26" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure.

300 KVA G.E. 2300 volts, 150 RPM generator direct connected to 18" x 30" Murray Corliss engine, 110 to 150 lbs. pressure.

225 KVA E. M. 2300 volts, 200 RPM generator direct connected 19" x 24" Chuse Unaflow poppet valve engine.

200 KVA Crocker-Wheeler, 240 volts, 400 RPM generator direct connected to Ames vertical Unaflow engine, 110 to 125 lbs. pressure, 5 lbs. gauge back.

180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18" x 21" Chuse non-releasing Corliss engine, 125 to 140 lbs. pressure.

150 KVA G.E. 240 volts, 225 RPM generator direct conncted to Ames Unaflow engine.

75 KVA Allis 2300/550 or 440 volt, 257 RPM generator direct connected to 12" x 16" Chuse 4 valve non-releasing Corliss engine.

ENGINE-GENERATOR UNITS
Direct Current

325 KW 35°—400 KW max. Crocker-Wheeler 125 volt, 300 RPM generator direct connected to Skinner vertical Unaflow non-condensing engine, 135 lbs. complete switchboard.

200 KW Triumph 125 volt generator direct connected to 18" x 36", Wisconsin heavy duty Corliss engine, 125 to 140 lbs. pressure.

75 KW Westinghouse, 125 volt, 1800 RPM non-condensing turbine gen.

75 KW Allis-Chalmers Terry, 125 volts, 2400 RPM non-condensing turbine-generator unit.

15 KW Crocker-Wheeler, 125 volts, 410 RPM generator direct connected to an Am. Blower vert. engine.

SPECIAL BARGAIN OFFERINGS

1 Manistee rotary jet condenser 7000 lbs. steam per hour, 28" vacuum direct connected to a 25 HP, 3 phase, 60 cycle, 220 volt, 900 RPM G.E. motor.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connected to 1700 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

750 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

500 KVA Westinghouse, 3 phase, 60 cycle, 600 volts, 514 RPM, belted generator.

75 HP G.E. 115 volt, 1200 RPM shunt wound direct current motor direct connected to 62½ KVA, 3 phase, 60 cycle, 2300 volt, 1200 RPM G.E. alternating current generator.

50 HP, 230 volt, 210/975/1200 RPM shunt wound, type SK, Westinghouse direct current motor.

1—ALLIS-CHALMERS SYNCHRONOUS MOTOR GENERATOR SET CONSISTING OF: 1500 KW 550/600 volts, 300 RPM compound wound interpole direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volts, 300 RPM, A.C. motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG
CLEVELAND 14 OHIO

WIRE OR PHONE
LONG DISTANCE 422

Delivery Today

2–2000 H.P. FAIRBANKS MORSE

LATEST MODEL 33 DIESEL ENGINES

Also complete generator plants 1875 KVA

OTHER IMPORTANT UNITS

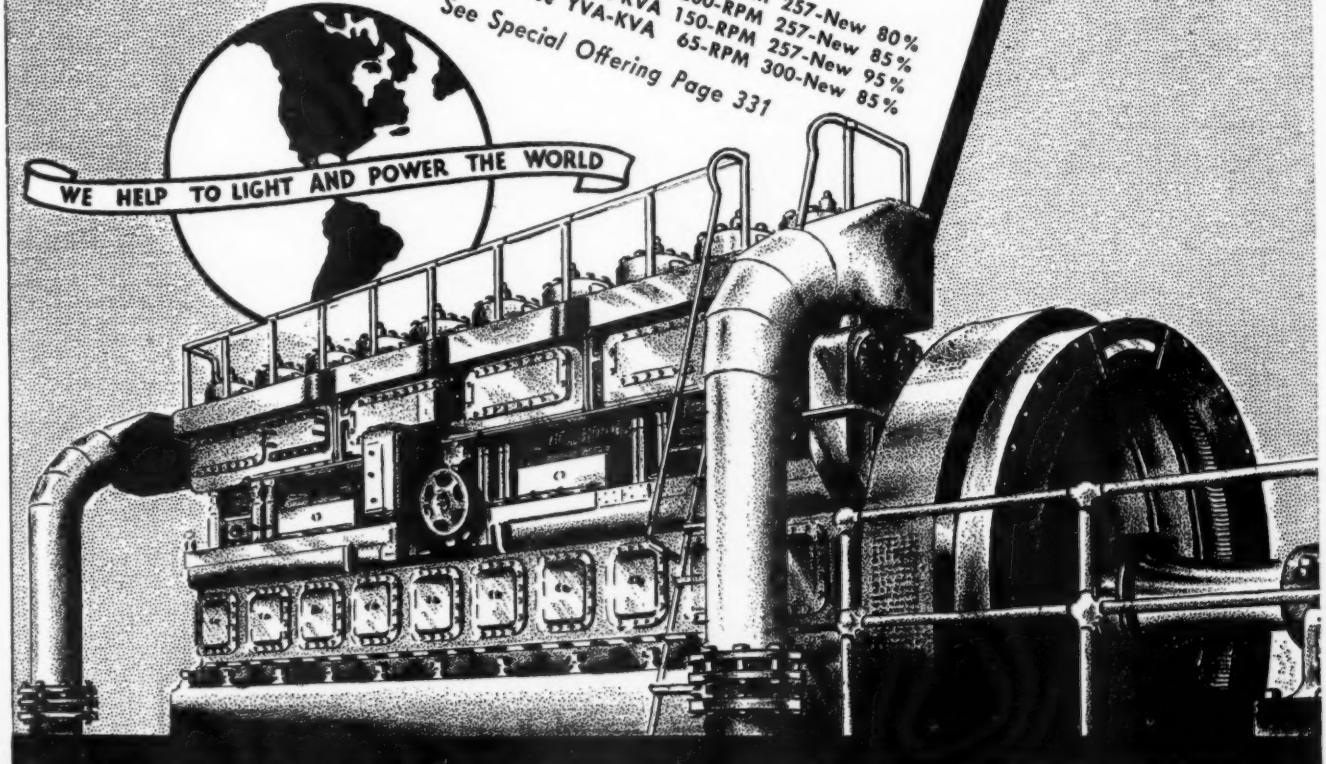
1-840 HP-Fairbanks Morse M -KVA 565-RPM 257-New 99%
2-720 HP-Fairbanks Morse M -KVA 465-RPM 257-New 95%
2-600 HP-Fairbanks Morse 33F-KVA 500-RPM 400-New 99%
2-450 HP-Fairbanks Morse 33E-KVA 375-RPM 360-New 95%

SPECIAL LOW PRICED OFFERINGS

These units, thoroughly inspected, represent low initial cost and low maintenance. They are particularly suited for emergency and standby service. Many organizations have obtained excellent results with units of this type, purchased from us.

1-360 Fairbanks Morse YVA-KVA 300-RPM 257-New 80%
2-240 Fairbanks Morse YVA-KVA 200-RPM 257-New 85%
1-180 Fairbanks Morse YVA-KVA 150-RPM 257-New 95%
1- 80 Fairbanks Morse YVA-KVA 65-RPM 300-New 85%

See Special Offering Page 331

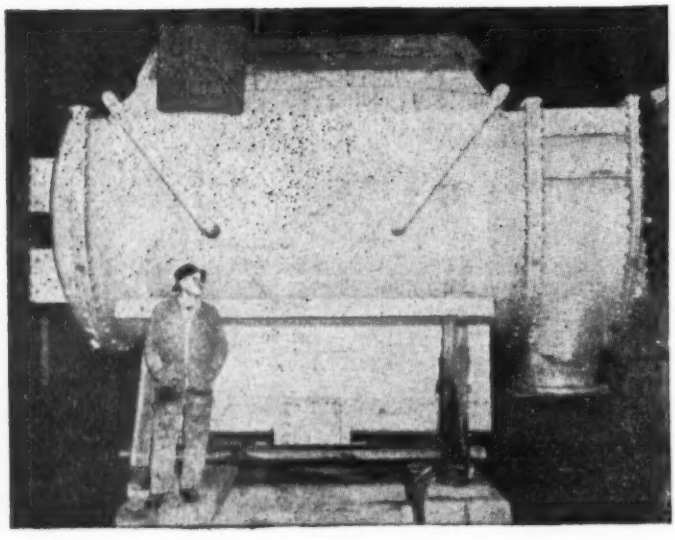


DIESEL MOTORS CORPORATION

PORT WASHINGTON, L.I., N.Y. TELEPHONE • ROSLYN 2000

5-NEW NEVER USED CONDENSERS in stock

Surface Type: Capacity 8280-sq. ft. Modern Laning
See Illustrations and Description Below: *Ask For Prices*



Immediate Delivery

ALSO IN STOCK

NEW

Steam Air Ejector

Condensate Pumps

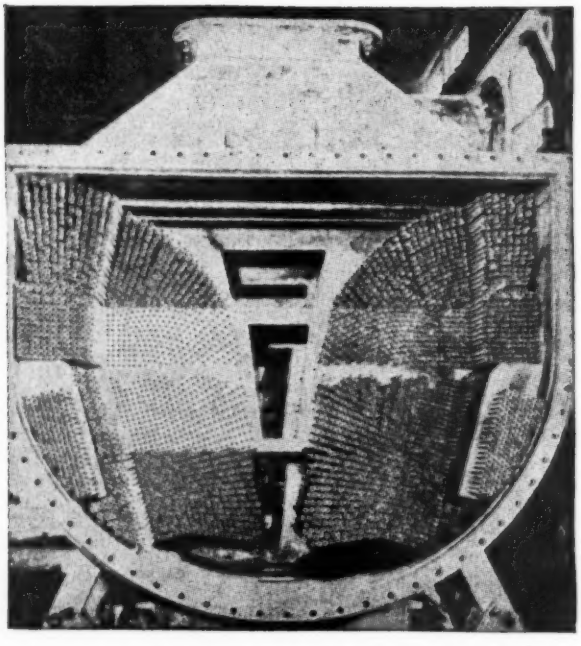
Circulating Water Pumps

ALSO NEW

5400-KVA., G.E., 450#-isp., 2300-v
Condensing Turbo-Generator
Never Used: New Surface Condenser

4600-KW, G.E., 450-isp.
Condensing: Surface Condenser
Used 30 Days only - Same as New

USED TURBO-GENERATORS: We always carry a large stock of high grade used machines in capacities from 500-KW to 15,000-KW.
Send Us Your Specifications.



Cross Section 8280-sq. ft., 2-Pass, Top Opening Surface Condenser; 3222-¾" O.D. BWG tubes 12' 2¼" Long. Note Modern Laning giving perfect steam distribution over tube bank.

ALSO SPECIALISTS IN: DIESEL ENGINES, BOILERS, GENERAL POWER PLANT EQUIPMENT. We OWN Outright all machines which we offer. Please use Bulletin Nos.

Correspondence Invited

CHARLES WEAVER & COMPANY

4045 Penobscot Building **Detroit 26, Michigan**

THREE AIR COMPRESSORS

Available For Immediate Shipment

1—3,000 C.F.M., 125 lb. press. W N 4 Sullivan Air Compressors 500 H.P., 3-60-2300 V direct coupled motor, exciter, panel board, after cooler and air receiver.

1—Schramm gas driven air compressor. Delivery 210 CFM, at a working pressure of 100#. Portable mounted on pneumatic tires with a spare set of steel wheels complete and self-contained. Purchased in 1945.

1—Gardner-Denver Air Compressor Vertical 7 x 5¾ x 5 870 RPM, 200 CFM, 100# Pressure. Direct connected to General Electric 40 HP 3 phase 60 cycle 440 V 870 RPM Motor

GASOLINE DRIVEN POWER PLANT

1—35 KVA gasoline driven power plant, Hercules engine, 4¼ x 4¾, Model WXLC-3, with U. S. Motors Generator, Type M-7, 220 volt, 3 phase, 60 cycle, 1200 RPM, complete self-contained with panelboard. Has a center tap 110 volts, single phase.

UNIFLOW ENG. GEN. SET

1—300 kw Chuse vertical Uniflow engine generator set 6 cyl. 10 x 12 150# pressure O# B.P. 450 RPM D.C. to 300 kw G.E. Alltemeter 3-60-2300 v. with D.C. exciter 125 v. Excellent condition. Rebuilt 1945. Reasonably priced for quick sale.

SKINNER UNIFLOW SET

1—300 KVA Skinner Uniflow Engine Generator Set 150# LSP 0-5# BP direct connected to Burke Alternator 3-60-480 V, 200 RPM with Exciter.

TURBINE

1—710 H.P. Terry Turbine, type GF, 3531 RPM, complete with reduction gear to 1000 RPM, 145# pressure, 0-60 B.P.

TURBO PUMP

1—520 GPM, 50' head, DeLaval Centrifugal Pump, 2940 RPM, direct coupled to DeLaval Turbine, 200# pressure, 0-5# B.P.

CENTRIFUGAL PUMPS

3—400 GPM, 635' Ingersoll Rand direct connected to Wesghse 125 HP motor, 360-2200 V, 3600 RPM.

2—500 GPM, 360' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—4500 GPM, 135' head, LeCourtney Centrifugal Pump 1800 RPM.

1—1000 GPM, 250' head, Ingersoll Rand Centrifugal Pump, 1800 RPM.

1—1200 GPM, 35' head American Well Works, 1750 RPM direct connected to 15 HP motor 3-60-2200/440 V.

2—520 GPM, 50' head, DeLaval Centrifugal Pump, 1150 RPM.

CARRIER AIR CONDITIONING UNIT

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 HP Motors mounted on common base with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3-60-220-440. New 1942. Has been in use one season.

VALVES

Stainless Steel Valves
Flanged, sizes and types from 1" up to 6"

NEW HOISTS

150 Yale & Towne 2 ton chain hoists, 20' lift. brand new in original packing.

MOTORS

4—300 H.P. Wesghse Slip Ring 3-60-2200/600 V, Type C W, complete with magnetic controls.

1—New 300 HP Westinghouse Type CS, 2200 Volt, 3 phase, 60 cycle, 600 RPM.

1—200 H.P. G.E. Synchronous Motor 3/60/4150, 600 RPM with starting panel, V-Belted exciter. New 1943.

16—Vertical Gear Head Motors, Crocker Wheeler TEFC 10 HP, 220/440 Volt, 60 cycle, 3 phase, 1745 RPM, Philadelphia Gear, output 425 RPM.

BUFFALO BLOWERS

10—Buffalo Steel Plate Blowers, 40", Type R. From 1,000 to 10,000 C.F.M., required H.P. from 6 to 28 H.P. for air at 70° F., 3.75 to 17.75 for air at 350° F. From 1,000 C.F.M. at 12" static pressure to 10,000 C.F.M. at 1.9" static pressure at 1750 R.P.M.

300 and 400 Ampere

ELECTRIC MOTOR DRIVEN ARC WELDERS

Lincoln—Hobart—General Electric Reconditioned—Guaranteed—New 1943

MISCELLANEOUS

1—3600 sq. ft. CR. Wheeler Surface Condenser.

1—20-ton Box Crane, hand operated, 39 ft. span, complete

Heat and Power Co., inc.

70 PINE STREET | **WHITEHALL 3-2172** | **NEW YORK 5, N. Y.**

ENGINEERED AGSCO DIESEL POWER

A typical diesel power plant engineered by AGSCO.

AGSCO POWER DEPENDABILITY ENGINEERING

POWER

As leaders in the power field for many years, AGSCO has served industry and municipalities with Diesel Plants in total capacities from 100 to 12,000 KW. We have served the power requirements of industrial and municipal plants in the last 12 months with a total of more than 150,000 horsepower.

DEPENDABILITY

AGSCO affords all power users the opportunity to install extremely desirable diesel power equipment. Prompt deliveries of industrial Diesel Power are supplemented by a written guarantee of satisfactory electrical and mechanical operation.

ENGINEERING

Our Engineering Department analyzes all installations and problems such as paralleling and criticals.

Write for Bulletins

DIESEL ENGINES

AG SCHOONMAKER CO INC.

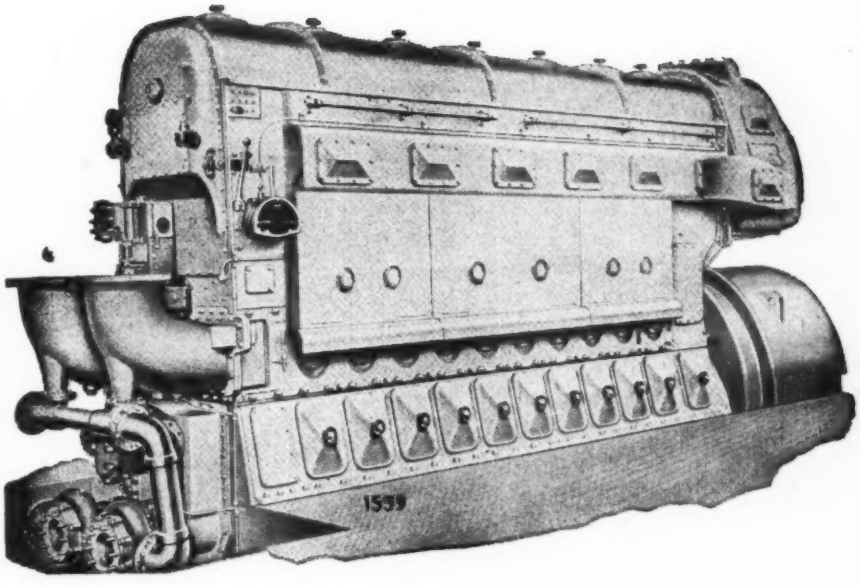
50 CHURCH STREET NEW YORK 7, NEW YORK

Cable Address: AGSCOMACH PHONE: WOrth 2-7225

Business Est. 1898

DIESEL POWER

ENGINEERED AGSCO DIESEL POWER



THREE—

3—1000 KVA, 3 phase, 60 cycle, 2300 volt. Westinghouse, 600 RPM. Direct Connected to:—

3—1250 H.P. Fairbanks-Morse Diesel Engines, Model 38D8 1/3, 10 cylinder, 8 1/8" bore, 10" stroke, 600 RPM.

These three uits are offered with complete equipment — switchboards, auxiliaries cooling equipment and silencing equipment.

DIESEL GENERATORS

ALTERNATING CURRENT

KVA	MAKE	HP	MODEL	RPM	YEAR
2—1875	Fairbanks Morse	2000	33E16	300	1939
1—1250	Nelseco	1500	6MI-63	300	1931
4—1250	Fairbanks Morse	1700	38D8 1/3	720	1944
12—1250	General Motors	1600	16-278-A	720	1944
3—1000	Fairbanks Morse	1250	38D8 1/3	600	1944
1— 625	Superior	750	OS	327	1938
1— 312	Enterprise	450	D8G-8	450	New
1— 300	Fairbanks Morse	360	YVA	257	1928
1— 250	General Motors	300	8-268-A	900	New
4— 250	General Motors	400	8-268-A	1200	1945
6— 125	General Motors	200	3-268-A	1200	1944
1— 94	Buckeye	112	E	400	1936

Write for Bulletins

ENGINES DIESEL

AG SCHOONMAKER CO INC.

50 CHURCH STREET NEW YORK 7, NEW YORK

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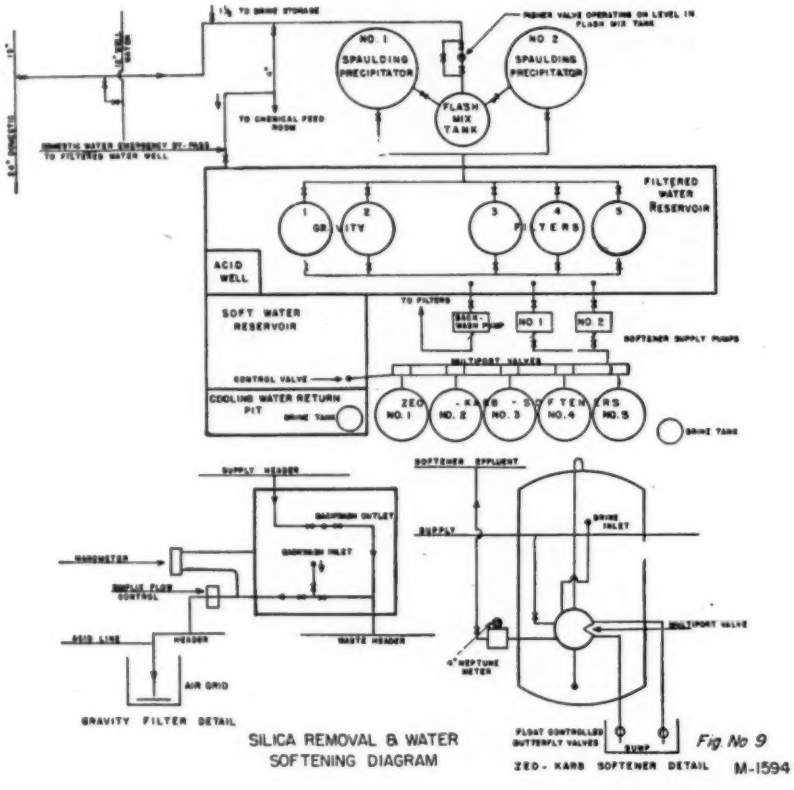
DIESEL POWER



SILICA REMOVAL & WATER SOFTENING DIAGRAM

Fig. No 9

M-1594

Water Treatment Plant—Modern—Available—Now

Designed for 1560 GPM with water of 11 grains, total hardness calculated as $CACO_3$.

Used for boiler plant—Boiler feed requirements..1080 GPM
—Boiler blowoff waste..... 144 GPM
—Precipitator, etc., waste.... 336 GPM

1560 GPM

Each softener to remove 2035 Kilograins of hardness between regenerations with water of 11 grains total hardness.

Including:

(A) Bailey indicating, integrating, and recording meter
(B) 10" Fisher pilotoperated flood valve
(C) 11' x 22' steel mixtank, motor driven agitator
(D) Ferrisul feed, electro-chemical control; two 5' x 5' lead lined steel tanks with agitators; 10' x 6' rubber lined feed tank and agitator, with pumps
(E) Spare electro-chemical control unit
(F) Lime feed, 10' x 6' chemical feed tank with agitator, pumps, electro-chemical control
(G) Dissolving lime tank 10' x 6' with agitator
(H) Two 39' x 22' high all steel Spaulding Precipitators with agitators
(I) Two Leeds & Northrup pH recorders
(J) Five gravity filters, 1575 GPM total, 315 GPM each—13' x 12' high, including graded anthrafilt
(K) Constant rate acid feed with Leeds & Northrup pH recorder and control, 2' x 2' lead lined acid tank, 7' x 5' high lead lined solution tank, orifice tanks, pumps, agitator
(L) Five sodium Zeo-Karb softeners 8' x 12' high with salt measuring tanks
(M) With miscellaneous pumps, motors, piping, chemicals, etc.

THOMAS ROME AND ASSOCIATES, INC.

307 E. FOURTH ST., CINCINNATI, OHIO

GLOW

SPECIAL—NEW PLATING GENERATORS

200 Amp., 10 to 15 volt, 1725 RPM, direct current, Master Plating Generators with overhung exciter.

MOTOR DRIVEN CENTRIFUGAL PUMP

Dayton Dowd, size 6x18 CSLF, rated 7250 G.P.M. 30 ft. head, at 685 RPM Centrifugal Pump mounted on common base and driven by:—
Continental 75 HP, 695 RPM, 220 volt, 3 phase, 60 cycle, drip proof motor.

COPPER OXIDE PLATING RECTIFIERS

500 Amp., 6 volts, Direct Current, for 440 volt, 3 phase, 60 cycle power, General Electric, Model 6RC120F2.

Note: Designed to be operated in series or parallel for higher voltage or current.

NEW DIRECT CURRENT MOTORS

25 HP, 1750 RPM, 230 volt, compound wound, Marble-Card motors, Marine type, drip proof.

A. C. GENERATORS

(3 phase unless otherwise noted)

KW	P.F.	RPM	Volts	Description
3	1	1200	120	Hobart, Ball Bearing
3.2	.8	1170	440	Westinghouse
4	1	1170	440	Westinghouse, Single Phase
7½	.6	1800	440	Electric Specialty, Ball Bearing
15	1	1800	127/220	General Electric, Single Bearing
20	.8	1200	120	Westinghouse, Single Phase, Ball Bearing
20	1	1800	110	Ft. Wayne, Single Phase
25	.8	1200	208/120	Westinghouse, Ball Bearing, New
40	8	1200	220	Burke, Single Bearing
50	.8	1200	120/208	Electric Machinery, Single Bearing, 4 Wire
87½	.8	900	110/220	Starr, Single Phase
100	.8	900	200	Crocker-Wheeler
100	1	900	2300	General Electric
120	.8	257	2300	General Electric, Single Bearing
150	1	600	480	Burke
150	.8	900	600	General Electric
150	.8	600	480	Crocker-Wheeler

AIR COOLED TRANSFORMERS

General Electric, 30 KVA, 460 volts primary, 230/115 volts secondary, 1 phase, 60 cycles.

General Electric, 35 KVA, 460 volts primary, 230/115 volts secondary, 1 phase, 60 cycles.

PLATING GENERATORS

Jantz & Leist, type IP, 4000 ampere, 2 to 12 volts, 425 RPM, direct current Plating Generators with or without driving motors.

GAS ENGINE—AC GENERATOR SETS

2½ KW Leland, type A, frame 50, 1800 RPM, 120 volt, single phase, 60 cycle, AC Generator, with Briggs & Stratton, Model ZZ, 6 HP, 1800 RPM Gasoline Engine, U. S. Army PE75AA, complete with gas tank and tool box.

5 KVA Onan, .8 P.F., 1800 RPM, 110/220 volt, single phase, 60 cycle, AC Generator with Onan, twin, 4 cylinder Gasoline Engine complete with starting panel.

7½ KVA, 120 volt, 3 phase, 60 cycle, AC Generator with 4 cylinder Wisconsin Engine, U. S. Army PE99, type VE4-1, size 3 x 3¼, complete with switchboard panel.

10 KVA, 110/220 volt, single phase, 3 wire, 60 cycle, Westinghouse, AC Generator with water cooled Jeep Engine Drive, U. S. Army PE95, 4 cylinder. Complete with switchboard panel.

25 KVA Westinghouse, 20 KW, .8 P.F., 900 RPM, 120 volt, 1 phase, 60 cycle, AC Generator, with LeRoy Gas Engine complete with control panel.

31.25 KVA, 25 KW Westinghouse, .8 P.F., 1200 RPM, 208/120 volts, 3 phase, 60 cycle, AC Generator with LeRoy Gas Engine complete with control panel.

Note: In addition to the above Engine Generator Sets, our stock includes practically all sizes up to 35 KVA both AC and DC, some with Diesel Engine Drive.

WORM GEAR RIGHT ANGLE GEAR HEAD MOTORS

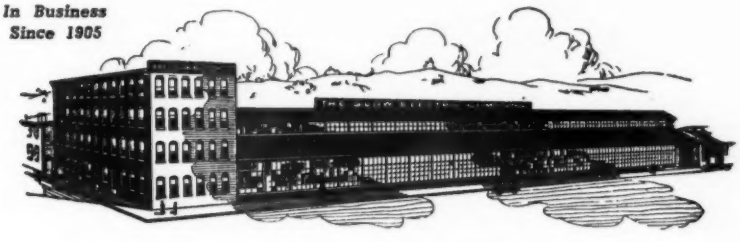
Master, ¾ HP, 1725 RPM, 440 volts, 3 phase, 60 cycle, output shaft speed 13½ RPM.

General Electric, ½ HP, 1725 RPM, 440 volts, 3 phase, 60 cycle, ratio 36 to 1, output speed 48 RPM.

General Electric, ¾ HP, 1750 RPM, 220/440 volt, 3 phase, 60 cycle, ratio 17½ to 1, output speed 99 RPM.

General Electric, ¾ HP, 1750 RPM, 220/440 volt, 3 phase, 60 cycle, ratio 36 to 1, output speed 48 RP.M.

In Business Since 1905



ELECTRIC CO.

Late Type TURBO-GENERATOR SET

Westinghouse 300 KW, 1200 RPM, 120/240 volt, compound wound, D.C. Generator with interpoles, directly connected to:

Joshua Handy Steam Turbine, 5965 RPM, for steam conditions of 440 lbs. per sq. inch gauge inlet pressure 28½" vacuum, 740 deg. F. total temperature. Including speed reducer, rheostat and balancer coil.

WELDER SETS

Amps.	Voltage	Manufacturers	Driven By
100	25	Lincoln	5 HP, 220 volt, 3 ph. 60 cy.
125	25	Ideal	7½ HP, 220 volt, 3 ph. 60 cy.
150	70	Arc Weld Mach. Co.	No Motor
150	45/35	Wilson Plastic Arc	7½ HP, 230 volt, Direct Current
150	25	Imperial	No Motor
150	6 arc capacity	Arc Weld Mach. Co.	30 HP, 220 volt, 3 ph. 60 cy.
175	55/25	Westinghouse	7½ HP, 220/440 V., 3 ph. 60 cy.
200	60/20	General Electric	1800 RPM—No Motor
200	60	Todd	7½ HP, 220 volt, 3 ph. 60 cy.
200	40	Lincoln	10 HP, 220 volt, 3 ph. 60 cy.
200	25	Lincoln	10 HP, 220 volt, 3 ph. 60 cy.
300	25	Westinghouse	15 HP, 230 volt, Direct Current Motor
300	25	Westinghouse	15 HP, 230 volt, Direct Current Motor
300	40	Wilson, single bearing for direct connection at 1800 RPM	
300	40	Lincoln	20 HP, 440 volt, 3 ph. 60 cy.
300	40	Lincoln, single bearing for direct connection at 1400 RPM	
300	40	Ideal	20 HP, 220 volt, 3 ph. 60 cy.
400	20	Wilson	No Motor
400	40	Lincoln	25 HP, 220 volt, 3 ph. 60 cy.
500	60	Westinghouse	45 HP, 220 volt, 3 ph. 60 cy.
1000	30	Westinghouse	50 HP, 220 volt, 3 ph. 60 cy.
1000	60	Westinghouse	92 HP, 220/440 V., 3 ph. 60 cy.

The items listed above are only a partial list of the large stock of electrical equipment which is available to meet your requirements.

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC HOISTS
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

933-943 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

LIQUIDATION SALE

(MOST EQUIPMENT 3 TO 4 YEARS OLD)

DIESEL ENGINES

2—300 HP Fairbanks Morse Model 38 O.P. 6 cyl. 2 cycle 5"x6" 1200 RPM (built 1936)

2—350 H.P. Superior Diesel Ser. #10501 & 10529, Type VD. MB, 8 cyl., Bore 9", Stroke 12", 600 R.P.M., built 1939

4—1800 H.P. General Motors 16-258S, 16 cylinder, 9½" x 12", 4 cycle, Buchi supercharged 900-750 RPM (new 1943)

2—1800 H.P. (HOR) Hamilton 9 cylinder, 2 cycle, 800 RPM, reversible (new 1944)

2—500 H.P. General Motors 8-268A, 8 cyl., 6½" x 7", 2 cycle, 1200 RPM (new 1943)

The above engines can also be supplied with fluid couplings, reduction gears and all other equipment suitable for ship installation.

DIESEL GENERATORS

4—1200 KW, DC, Allis Chalmers, 525 V. 750 RPM Driven 1700 HP General Motors Diesel 16-278A 750 RMP (New 1943)

2—200 KW, AC, 3/60/440 and 40 KW, DC, 120/240 V Driven by 500 HP General Motors Diesel, 8-268A, 8 cyl., 6½" x 7" 2 cycle, 1200 RPM (new 1943)

3—60 KW, DC, 225 V. driven by 90 H.P. General Motors Diesel 6-71, 6 cylinder, 4½" x 5" 1200 RPM. New 1943

2—20 KW, DC, 250 V, driven by 30 H.P. General Motors Diesel 2-71, 2 cylinder, 4½" x 5" 1200 RPM. New 1943

2—60 KW, DC, Generator, 250 V. driven by 110 H.P. Buda Diesel, 8 cylinder, 4 cycle. New 1944

All auxiliary equipment can be furnished.

MOTORS

5—DC 25 HP, 35 HP, 50 HP, type CO 1808, 230 V, all variable speed 550 RPM to 2100 RPM

500—DC, from ½ HP to 60 HP, 120 V, various speeds

18—General Electric AC synchr. motors, 3 phase, 6000 HP, 93 1/3 cycle, 2700 V, 400 RPM, or 3800 HP, 60 cycle, 1700 V, 257 RPM

28—DC 1500 HP, W'hse, 525 V, 600 RPM

HOISTS

6—Mead Morrison Co., 2 drum hoisting engines type H197, driven by 51 HP G.E. motor 230 V, DC

5—Mead Morrison Co., single drum derrick swingers type 138, driven by 5 HP G.E. motor 230 V, DC

NOTE: The above hoists are complete with controllers

2—Jaeger Utility hoists, single drum, driven by Continental 6 cylinder gasoline engine.

TURBO-GENERATORS

6—4600 KW G.E. 3 phase, 93 1/3 cycle, 2700 V, 5600 RPM (or 2900 KW, 60 cycle, 1700 V, at 3600 RPM), 410# cond., complete with 3800 sq. ft. condensers, amplidyne motor generators, circulating and condensate pumps, etc.

6—300 KW G.E. type ATI 3/60/450, 1200 RPM, cond., compl. with 40 KW exciters, condensers, switchboards.

8—200 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse 180/220 V, DC, 3000 Amp, 1200 RPM, cond.

1—300 KW 120/240 V. D.C. 1200 RPM

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V. DC, 1800 RPM, cond.

NOTE—MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

MOTOR—GENERATORS

AC to DC and DC to AC—various sizes from 1 HP to 80 HP.

GENERATORS

28—1200 KW DC Allis Chalmers, 525 V, 750 RPM

TURBO-BLOWERS

9—Sturtevant size 24—20,000 CFM at 17" S.P. turbine, 191 HP, 400# steam

CONDENSERS

4—7800 Square Feet—¾" brass tubes, two pass.

SWITCHBOARDS

All sizes, AC and DC, whole or in parts, circuit breakers, current transformers, switches, meters, recorders, etc, etc.

TRANSFORMERS

5—50 KVA 3—10 KVA
15—25 KVA 5—3 KVA
} from 440 V to 120 V, all single phase, 60 cycle, dry type

BOILER

6—Express, Boilers, modied D type, Foster Wheeler, 30,000# steam hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

6—Wickes Boiler 628 H.P. 3 drum, Navy Types, 250 pounds pressure.

2—Cyclotherm 3000 pounds steam per hour.

BOILER FEED PUMPS, TURBINE DRIVEN

1—DeLaval 675 GPM 725# dischge., 4900 RPM, steam 540#

1—DeLaval 600 GPM 575# dischge., 4600 RPM, steam 400#

2—Worth'ton 750 GPM 375# dischge., 3500 RPM, steam 240#

5—Ing. Rand 165 GPM 575# dischge., 4650 RPM, steam 375#

3—DeLaval 125 GPM 575# dischge., 7000 RPM, steam 400#

CENTRIFUGAL PUMPS

60—Various sizes up to 15,000 GPM, up to 725# disch. pr. steel and bronze, motor and turbine driven.

RECIPROCATING STEAM PUMPS

50—Simplex and duplex, various sizes, bronze and steel

CENTRIFUGES

15—Sharples
15—DeLaval
} Oil purifiers and oil clarifiers, capacity 100 GPH and 150 GPH, with motors and pump

HIGH PRESSURE AIR COMPRESSORS

2—Ingersoll Rand type 40, 4 stage 3000# press. 20 cft. driven by G.E. 3/60/220/440 motors 50 HP

1—same, driven by Waukesha gas engine model GBZ 1111

2—Ingersoll Rand class B, 3 stage, 3,000# press, 7½ cu. ft., driven by G.E. 3/60/440 motors, 24 HP.

DISTILLING PLANTS

2—Griscom Russell Soloshell double effect, 8000 gals. per day, complete with pumps

3—Cleaver Brooks Co., 5000 gals. p. day, self contained units complete with boiler pumps and fans

2—Ingersoll Rand 40,000 gallons per day, triple effect, low pressure.

1—Condenser Service 80 tons per day, double effect

FANS

150—from 3,000 to 16,000 CFM at 2" to 3" S.P. with AC and DC motors.

FUEL OIL HEATERS

24—Griscom Russell sect. G-fin, 86 sq. ft.
1—Griscom Russell, 4 sect., 6 fin.

FEED WATER HEATERS

7—Blowers (Roots Connersville) size 16" x 18", connected to G.E. induction motor, 200 H.P., 3 phase 60 cycle, 2200 Volt, 705 RPM

2—Blowers (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.

Tel.: REctor 2-1334

ARRANGE FOR INSPECTION

2500 KW EXTRACTION-CONDENSING UNIT

480 volt, 3 ph. 60 cycle. Built for 175/185# 525° f.t.t. Extraction 58,000#/Hr. max. at 5# g. (1920) Turbine now being rebuilt; will arrange for extraction at 30# g. if required. Includes 35 KW MG exciter set—all switchgear, accessories, and auxiliaries.

1500 KW G.E. CONDENSING UNIT

150/250# initial—60/3/480 v. rewound
Surface Condenser—all auxiliaries—complete—good condition—feed water extraction

90,000#/Hr. 250 PSI B&W integral FURNACE BOILER—

GAS and OIL fired. Never installed—can ship and install on short notice.

FURNACE TRANSFORMERS

3φ 1500 KVA—12000 primary—rebuilt
3φ 4000 KVA—22000 primary—new
3φ 4000 KVA—22000 primary—new—1944
3φ 4000 KVA—13200 primary—new—1944
1φ 3600 KVA Bank—13200 primary—new—1944
1φ 150 KVA (2 units) 1200 primary w/Scott taps
3φ 200 KVA 230 primary—120/60 secondary
New—with voltage regulator

VERY GOOD EXTRACTION-CONDENSING MACHINE—CAN SHIP QUICK

1000 KW—0.8 p.f.—250# 550° 25# g. extraction—60/3/480 11 stage turbine—double bucketed in high—13.5#/KWH condensing W.R.—direct connected exciter—surface condenser switchgear—Built 1929—mate duplicate installation—regular maintenance and renewals.

FOR YOUR FUTURE PLANNING—AVAILABLE SUMMER 1947

10,000 KW 0.8 p.f.—200# 500° 35# g. extraction—60/3/2400 semi-double flow—turbo built about 1915-16 but completely overhauled and reconditioned 1943—excellent physical condition—surface condenser, all auxiliaries, switchboard, etc.—extraction uncontrolled.

STRAIGHT—CONDENSING TURBO SET 450# 650° WESTINGHOUSE

1500 KW—0.8 p.f.—60/3/240—built 1928—surface condenser all auxiliaries—reported excellent physical condition.

TURBO ALTERNATORS

Condensing

1000 KW 60/3/600 V G. E. turbo generator built 1925 for 235#—surface condenser and all auxiliaries.
1000 KW (3 units) 2400 V 150# 100° Jet Cond (new about 1922)
1250 KW 2400 V 200# 100° Surf Cond (new 1924)
1500 KW 480 V 200# 100° Jet Cond (new 1920)

Non-Condensing

100 KW 240 V 175# 100° ISP 0 to 5# g. BP (new 1921)
1500 KW 2400 V 175# 100° ISP 10# g. BP (new 1926) rebuilt
1500 KW 240 V 400# 650° ISP 90# g. BP (new 1928)

DC TURBO UNITS

1000 KW 250 V 150# Surface Condenser
750 KW 250 V 16#/165# (M.P.) Jet Condenser
500 KW 250 V 16#/165# (M.P.) Condenser
150 KW (2 units) 250 V 225# 25# g. BP modern design

ENGINE GENERATORS
60 cycle 3 phase

400 KW 480 V Allis Corliss 175# 150° ISP 25# (new 1924) excellent unit
600 KW 2400 V Chuse Uniflow 200# C or NC (new 1922)

DC ENGINE SETS

200 KW (3 units) 250 V DC Hamilton Corliss left hand
250 KW 1250 V DC Erie Ball built 1916 (2 units)

BOILER PLANT

300 HP 200#—gas fired—water treatment—building—stacks—excellent

TRANSFORMERS

100 KVA to 4000 KVA 33, 22, 13.2, 2.4 KV primaries

BOILERS

Water Tube

600 HP (2 units) 160# pulverized firing—sect'l hdr. Pennsylvania
400 HP 400# 650" sect'l hdr (new 1928)
519 HP Heine Boiler—CAN SHIP INTACT. MOST MIDWEST POINTS—NOT NECESSARY REMOVE OR REPLACE TUBES. Built 1928 for 180# and now approved 180#—Coxe chain grate stoker equipped.

Fire Tube

90 HP 118# stoker equipped ASME Mich. Code HRT
250 HP 125# grates and stack non-code Scotch Marine
125 HP (ten units) 300# Oil Country Boilers ASME Code
400 HP—2 units—Scotch Marine ASME Code—150#

And a few modern 450-500-700 psi Generating Units

DIESEL ENGINE GENERATORS
60 cycle 3 phase

400 KW/600 HP 480 V Clark 2 cycle vertical 400 RPM
375 KW/560 HP 2400 V Fairbanks Model 33, 257 RPM
465 KW/700 HP 2400 V Fairbanks Model 33, 257 RPM
440 KW/650 HP—2400 v. ENTERPRISE—rebuilt—guaranteed
1500 KW—Plant complete—Fairbanks-Morse—fair condition

DIRECT CURRENT UNITS

340 KW (two units) 250 V. Nordberg 3 cyl. 2 cyc.
525 H.P. @ 257 RPM—Elliott Generator
Each unit complete. BUILT 1943. (Price is reasonable)

POWER UNITS

180 HP Fairbanks Model 32E12 (new unit)
225 HP Buckeye 6 cylinder 400 RPM complete (new 1941)

FREQUENCY CHANGERS

3125 KVA 60/3/2300—25/3/2300—complete

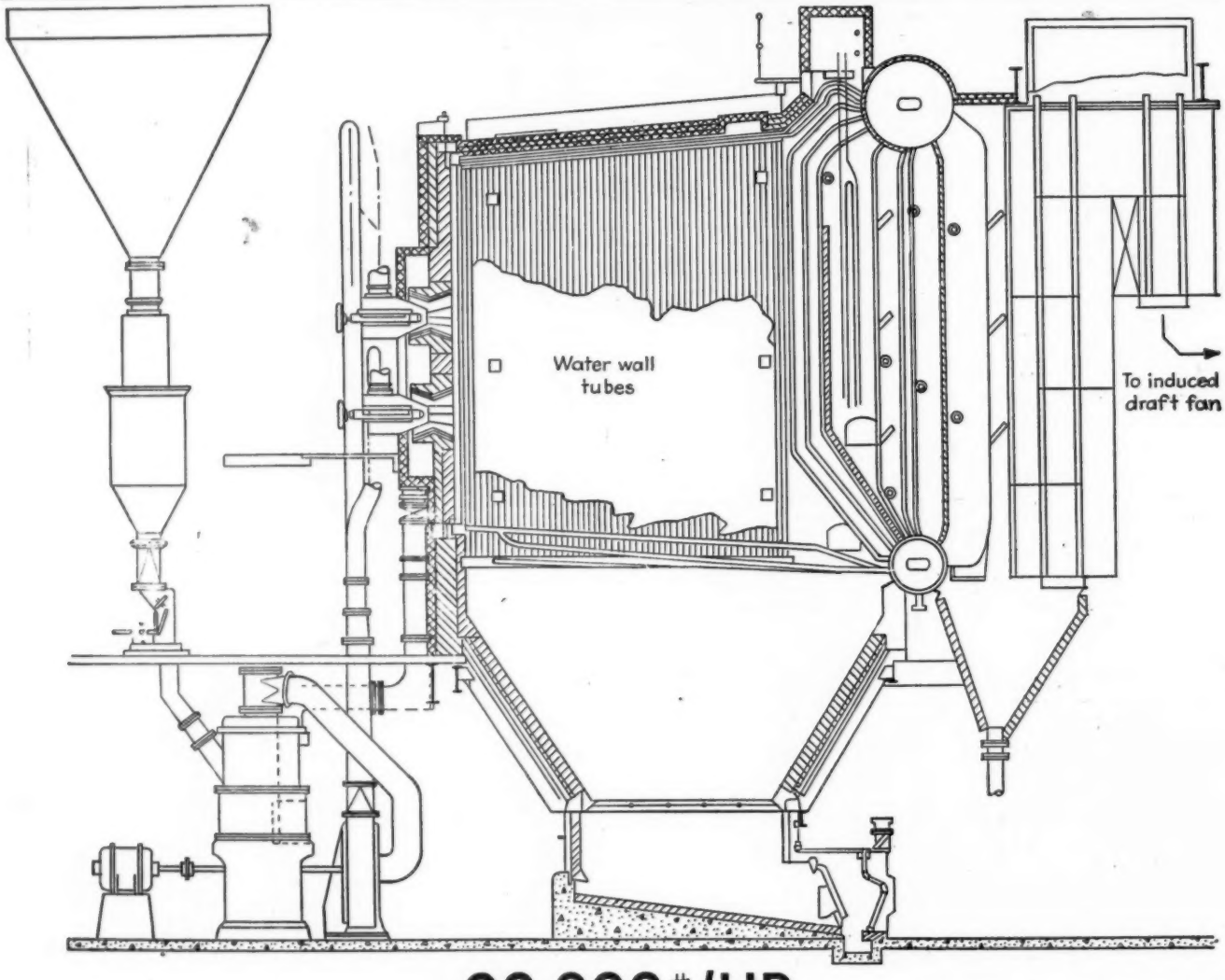
SPECIAL

A—250,000#/Hr. 450# pulverized coal fired steam generator—complete and in good condition.
B—100,000#/Hr. 700# stoker fired unit complete and in good condition.

PAUL STEWART & CO., INC.

UNION TRUST BUILDING . . CINCINNATI 2, OHIO

Over 50 Years of Service



90,000#/HR

550/600 Psi Pulverized Fired Combustion Engineering

7—Diamond Flow Blowers; 2—Raymond Pulverizers;
4—C. E. Burners; Water Columns; 2—Raymond Coal Scales and Feeders; full load oil firing

Main Header ..... 18" with 4 automatic electrically operated valves controlled from boiler panel

Draft Fans ..... Forced and Induced turbine driven

Control System ..... Smoot control, 3 panels, with starter for pulverizer, Bristol recording meter, water gauges, draft gauges, etc.

Unit built and installed 1940 Designed for 600#—Boiler heating surface, 10,599 sq. ft.; Water wall surface 2,699 sq. ft.; C. E. Tubular air heater Type VU; Elesco superheaters for 700/750°F. T.T.; for operation on feedwater of 298°F.
Efficiency overall—approximately 85%.

Mill Capacity ..... 7400# coal/hour each—(coal 13% moisture, grindability 50/70 Hardgrove—crushed to ¾ in. through VSS 200 screen)

Capacity ..... 90,000#/hr., 550 psi; 690°F., with coal of grindability 50 crushed to ¾" round, moisture 13% max., BTU 11,000, Ash softening 1950°F.

Also—Water Treatment Plant 2 units separable—total of 1560 GPM—Sodium ZeoKarb System—with precipitators, consisting of
2—Steel tank Spaulding precipitators—780 GPM ea.
5—Steel filters—gravity type 1250 GPM (315 GPM ea.)
5—ZeoKarb Na softeners—1020 GPM; each to remove 2035 kilograms of hardness between regenerations.

Also—Coal Handling System. 100 Ton/Hr.—560 Ft. Link Belt with supporting structure—Belt unloader—Coal Yard drag—crushers—screens.

THOMAS ROME and ASSOCIATES, Inc.

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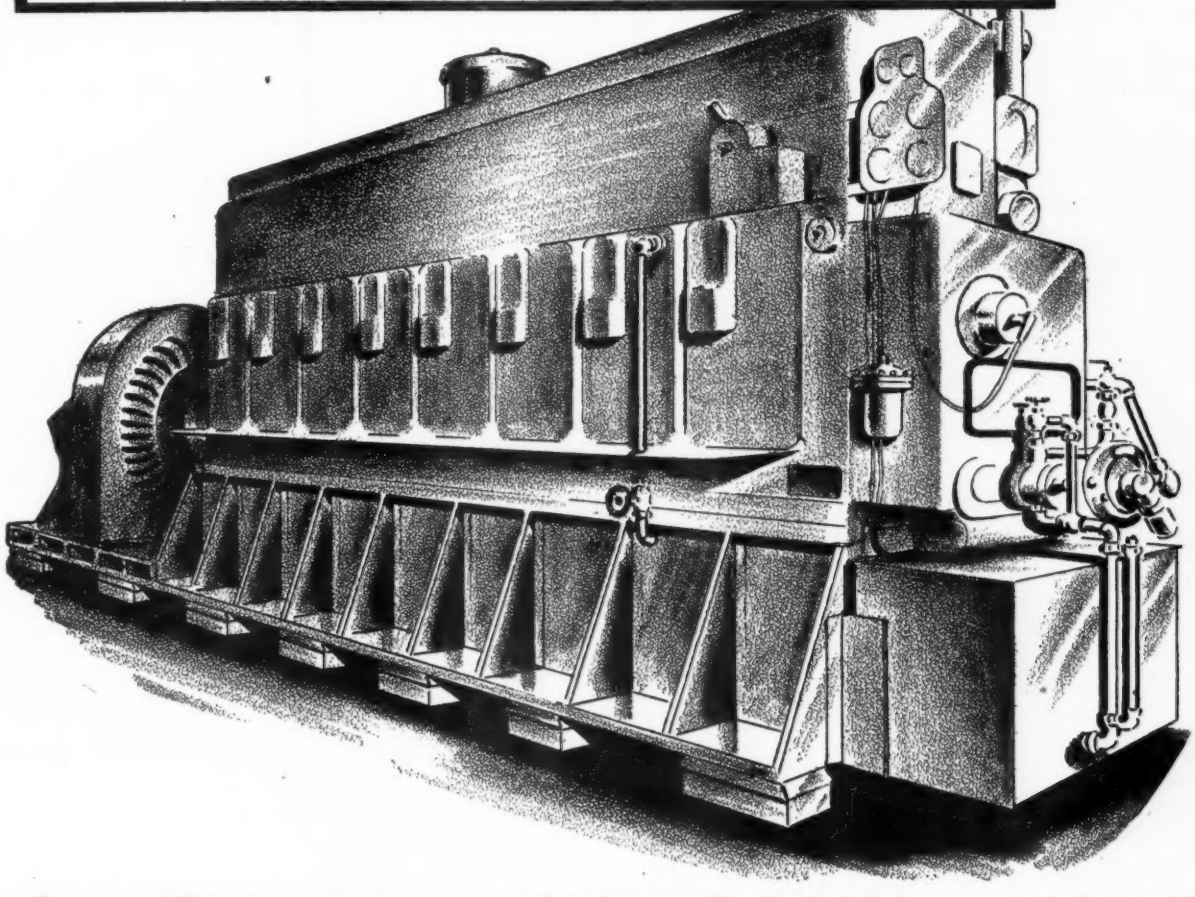

38 NEW BUCKEYE DIESEL ENGINES

★ 22.5 — 300 — 450 H. P.
★ 4—5—8 CYLINDER MODEL 80
★ 10½ x 12 — 600 R. P. M.

ALSO COMPLETE GENERATOR PLANTS
150—200—300 KW
SEVERAL OTHER UNITS 100 TO 2000 H. P.

Larger and Smaller Units Shown on Page 321

DIESEL MOTORS CORPORATION
PORT WASHINGTON, L. I., N. Y.
TELEPHONE • ROSLYN 2000

WE HELP TO LIGHT AND POWER THE WORLD

THE PICK OF POWER EQUIPMENT

TURBINE UNITS—60 Cy.

1—25000 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
2— 3750 KVA Westinghouse Cond.
1— 3750 KVA Westinghouse Extrac.
1— 3125 KVA General Electric Cond.
2— 3125 KVA General Electric Extrac.
1— 1563 KVA Westinghouse Extrac.
2— 1250 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 225 KVA General Electric Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNIT—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Chuse Uniflow
1—375 KVA Harrisburg Uniflow
1—325 KVA Skinner Uniflow
1—312 KVA Ames Uniflow
1—300 KVA Skinner Uniflow
1—225 KVA Skinner Uniflow
1—150 KVA Ames Uniflow
1—150 KVA Harrisburg 4 valve

D. C. STEAM ENGINE UNITS

1—600 KW Ames Uniflow, 250 V.
1—500 KW Ames Uniflow, 250 V.
1—400 KW Ames Uniflow, 250 V.
1—350 KW Ridgway Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—150 KW Ridgway 4-valve, 125/250 V.

DIESEL ENGINE UNITS

2—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
1— 750 HP Worthington, 250 V., 60 cy. gen.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 500 HP Gen. Motors, 480-2400 V. gen.
1— 300 KW Buckeye, 450 V. 60 cy. gen.
1— 300 HP McInt. & Sey., 480 V. 60 cy. gen.
2— 250 HP Gen. Motors, 460 V. 60 cy. gen.
1— 150 HP Buckeye 400 RPM eng. only
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

2—1409 HP B & W 650-lb. Stokers
2— 748 HP Edge Moor 250-lb., Stokers
2— 560 HP Erie City 460-lb.
1— 519 HP Titusville 200-lb., Stoker
5— 492 HP Heine 180-lb., Stokers
2— 469 HP B. & W. 425-lb., Pulverizer
2— 323 HP Springfield 225-lb., Stokers

SYNCHRONOUS MOTORS

4—6000 HP G. E. 60 cy. 2300 V. 90 RPM
1— 400 HP Al. Ch. 60 cy. 2300 V. 514 RPM
1— 300 HP G. E. 60 cy. 2200 V. 600 RPM 3-bearing
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 2300 V. 900 RPM
1— 100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTIONS MOTORS—60 Cy.

1—1000 HP West. Slip ring 2200 V. 360 RPM
1— 800 HP G.E. sl. rg. 2200 V. 450 RPM
1— 500 HP G.E. sl. rg. 2200 V. 3600 RPM
4— 150 HP Burke sq. cage B.B. 1800 RPM
3— 150 HP Cr. Wh. sq. cage B.B. 1200 RPM
2— 150 HP G.E. 440 V. 600 RPM
2— 120 HP G.E. sq. cage 220 V. 3600 RPM
3— 75 HP Cr. Wh. sq. cage B. B. 1200 RPM
1— 60 HP West. 2200 V. 1200 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC, 60 cy.
1— 400 KW Allis Chal. 275 V. DC 25 cy.
2— 300 KW Allis Chal. 275 V. DC 25 cy.
1— 300 KW Westinghouse 250 V. DC, 60 cy.
1— 250 KW Allis Chal. 275 V. DC 25 cy.
1— 75 KW Westinghouse 125 V. DC, 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
1—2000 KW General Electric 600 V.
2—1500 KW Westinghouse 250 V.
1—1000 KW Allis Chalmers 600 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW General Electric 275 V.
4— 500 KW Westinghouse 275 V.

FREQUENCY CHANGERS

1—3125 KVA G. E. 25/60 cy. 300 RPM
1—2150 KVA G. E. 25/62½ cy. 750 RPM
1—1875 KVA G. E. 25/60 cy. 300 RPM
1—1250 KVA West. 25/60 cy. 300 RPM
2—1000 KVA G. E. 25/60 cy. 300 RPM
1—1000 KVA Al. Ch. 25/62½ cy. 375 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G. E. 60/25 cy. 300 RPM

TRANSFORMERS—1 Ph. 60 Cy.

2— 2000 KVA West. 69/34.5-4.8/2.4 KV.
4— 333 KVA Al. Ch. 25410/44000-13200/23000Y V.
4— 500 KVA G. E. 33000-2300 V. 1 ph.
3— 150 KVA G. E. 33000-11000 V.
1—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
3— 1000 KVA West. 26400-4150 V.
1— 1000 KVA G. E. 24000-11500 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
2—10000 KVA Pitts. 13200-4600 V. 3 ph.
4— 2500 KVA G. E. 13200/22800Y—2300 V.
3— 1667 KVA Wagner 13200-550 V. 1 ph.
2— 1000 KVA G. E. 11500/23000-575 V.
3— 400 KVA G. E. 11500-2300 V. 1 ph.
2— 1500 KVA West. 4000-2300 V. 3 ph.
1— 300 KVA West. 450-1000 V.
3— 15 KVA West. 440-220/110 V.

OIL CIRCUIT BREAKERS

2— 400 A. 25 KV G. E. FKO136
2—1000 A. 23 KV Kelman CB76
4— 600 A. 15 KV G. E. FHKO139-24BS
1— 600 A. 15 KV G. E. FK037
2— 400 A. 15 KV G. E. FHKO136

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Large Stock — Immediate Delivery

NEW—*High Pressure*

4—Model 12C Cyclotherm Steam Generators comp. with Return System 100# W.P.
1—25 H. P. Steam Generator comp. with Return System 125# W.P.
4—25 H. P. Kewanee Scotch Marine for Oil Firing 100# W.P.
1—32 H. P. Kewanee Firebox Type comp. with Oil Burner, Hand Fired Grates, Stack, Fire Brick, etc. 100# W.P. Packed for Export.
1—80 H. P. Cyclotherm Steam Generator (Light Oil) 125# W.P.
1—80 H. P. Cyclotherm Steam Generator (Heavy Oil) 125# W.P.
1—150 H. P. Cyclotherm Steam Generator (Heavy Oil) 100# W.P.
2—200 H. P. Union Iron Works Universal for Oil Firing 150# W.P.

USED—*High Pressure*

2—15 H. P. Cleaver Brooks Steam Generators (Light Oil) 100# W.P.
1—50 H. P. Cleaver Brooks Steam Generator (Light Oil) 100# W.P.
1—50 H. P. Fitzgibbons with Shaking Grates 100# W.P.
6—90 H. P. Cyclotherm Steam Generators 125# W.P.
2—100 H. P. Titusville Economic Type for Oil or Coal 150# W.P.
2—200 H. P. Keeler HRT ASME 150# W.P. with Oil Burners and Pumping Equipment.
2—200 H. P. Keeler HRT ASME 150# W.P. with New Skelly Stokers
2—250 H. P. Heine Box Header Water Tube 180# W.P.
2—300 H. P. Oil City (Heine Type) Hand Fired Grates ASME 160# W.P.
1—489 H. P. Heine Water Tube Hand Fired Grates ASME 160# W.P.
2—600 H. P. Springfield Sectional Header ASME 200# W.P.

We also carry a large stock of Heating Boilers, both NEW and Used for Immediate Delivery.

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300 KW G. E. 600 D.C. 2300/4000 A.C. 1200 RPM, 6 PH. 60 CY. COMPLETE SWITCHGEAR AND TRANSFORMERS.

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150 KW G.E. SYN. 600 V. 2300/4000 A. C. 1200 RPM, 3 PH, 60 CY. COMPLETE MANUAL SWITCHGEAR.

Each unit listed above is owned by us and is available now for immediate purchase

WALLACE E. KIRK COMPANY

Incorporated

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FOR SALE

50, 75, 100, 150, 250 HP Slip Ring Motors
50, 75, 100, 150, 800 HP Squirrel Cage Motors
750 KW, 230 V. GE-Curtis Turbo Gen.
177 HP (2) 260# P. Marine Type Boilers
187 KVA 240 V. Gen. D/C 4 Val. Engine
150 HP (2) ASME 150# HRT Boilers—complete
150 KVA (2) F-M—Full Diesel Eng.—Gens.

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2—1000-KW., 8-Cylinder General Motors Diesel Engines, direct connected to General Electric Generator, 3/60/440-2300-V, 720-RPM., complete with direct connected Exciters, Switchboards, etc.

1—480-KW, 8-Cylinder WORTHINGTON (New) 400-RPM, direct connected to General Electric Generator, 3/60/480-V, 400-RPM., complete with Exciter, Switchboard, etc.

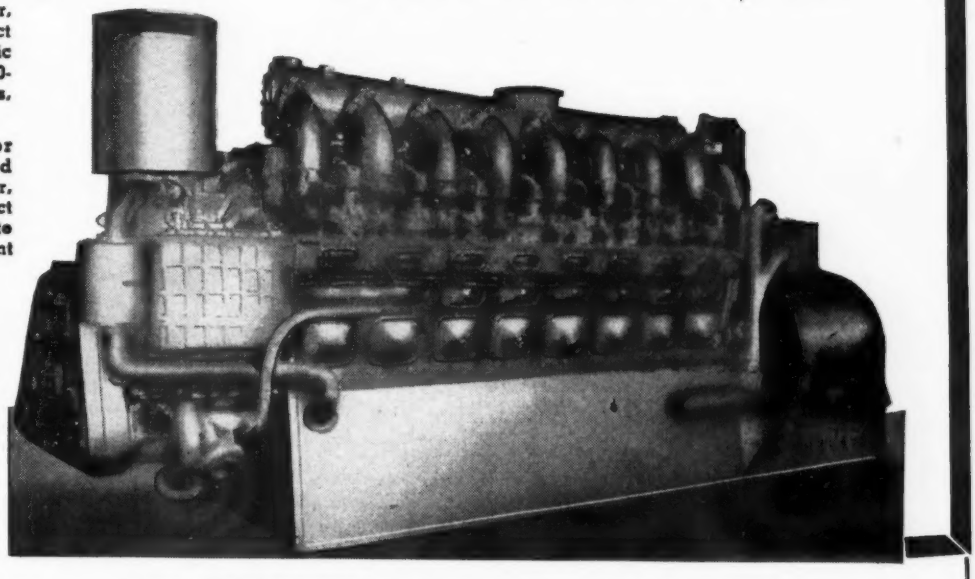
2—300-KW. Buckeyes, 6-cylinder, Diesel Engines, 600-RPM, direct connected to General Electric Generator, 3/60/440-V, 600-RPM., complete with Exciters, Switchboards, etc. New.

1—250-HP.-WINTON, 4-cylinder Diesel Engine Direct connected to General Electric Generator, 3/60/240-V, 400-RPM. Direct connected Exciter. Complete with Switchboard. Excellent condition.

1—160-HP.-WINTON Diesel Engine, 6-Cylinder, Direct connected to General Electric Generator 3/60/240-V, 400 RPM. Direct connected Exciter, 5-KW, 125-V, 400-RPM. Complete with Switchboard. Excellent Condition.

1—140-HP., WINTON, 3-cylinder Diesel Engine, 400-RPM., direct connected to an Ideal Alternating Generator, 3/60/240-V, complete with direct connected Exciter, Switchboard with starting and control equipment.

DIESEL ENGINES



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6—Brand new and unused B&W Sectional Header Cross Drum Boilers with steel erection and enclosing panels, maximum 58,000# steam each, 250 to 465# pressure, 750° total temperature, equipped with oil burners, superheaters, and economizers.
6—Brand new and unused Combustion Engineering Company sectional header cross drum Boilers with steel erection and enclosing panels, maximum 58,000# steam each, 250 to 465# pressure, 750° total temperature, equipped with oil burners, superheaters, and economizers.
6—Foster Wheeler-Vogt new and unused Sectional Header Cross Drum Boilers with steel erection and enclosing panels, maximum 41,000# steam each, 250 to 465# pressure, 750° total temperature, equipped with oil burners, superheaters, and economizers.
6—New Deaerating Heaters, capacities 50,000 to 79,000# per hour.
3—New Surface Condensers, 8200 Sq. Ft.
2—Surface Condensers, New, 1500 Sq. Ft.
6—New Surface Condensers, 585 Sq. Ft.
6—New Evaporators, 40 tons per day capacity.
6—Air Ejectors, Twin, 2-stage New, with inner and after Condensers, for 6000 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New, With inter and after Condensers, for 4000 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New, With inter and after Condensers, for 1000 KW Turbines.
3—Air Ejectors, Twin, 2-Stage, New, With inter and after Condensers, for 500 KW Turbines.
6—New Westinghouse variable capacity turbine driven Blowers, 19,000 CFM.
12—New Motor Driven Condensate Pumps.
2—New Main Circulating Pumps, 13,000 GPM, 30' Head.
6—New Main Circulating Pumps, 10,500 GPM, 25' Head.
2—1000 KW Slightly Used 3 Ph. 60 Cycl. 440 V. G. E. Condensing Turbines, 400# Pressure.
1—200 KW Slightly Used 3 Ph. 60 Cycl. 440 V. G. E. Condensing Turbine, 400# Pressure.

SUNDFELT EQUIPMENT COMPANY, INC.

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1—10,000 KW 11,000V Cond.
3— 3,000 KW 600 V Cond.
1— 2000 KW 600 V Cond.
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1— 1250 KW 2300 V Cond.
1— 1000 KW 440 V Extrac.
1— 1000 KW 2300 V. Cond.
1— 750 KW 240 V Extrac.
2— 500 KW 600 V Cond.
1— 500 KW 240 V Cond.
1— 250 KW 240 V N. D.
1— 125 KW 600 V Extrac.
2— 100 KW 115 V D.C.

ENGINE GENERATORS
2—600 KW. 2300 V. Uniflow
1—168 KW. 600 V.
1—280 KW.480 V.
1—250 KW. 480 V.
1—150 KW. 480 V.
1—125 KW. 125/250 V.D.C. Uniflow

TURBINES ONLY
1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS
1—90,000# 550 PSI
1—50,000# 250 PSI
1—30,000# 425 PSI
2—507 HP 160#
1—500 HP 400#
1—460 HP 250#
1—200 HP 160# HRT
1—150 HP 150# HRT
1— 75 HP 150# NEW

AIR COMPRESSORS
1—6000 CFM 50# Motor
1—1573 CFM 100# Motor
1—1300 CFM 50# Steam
1—1700 CFM 100# Steam
1— 600 CFM 350# Steam
1—5000 CFH 600# Belted
1—1000 CFH 3000# Belted

TRANSFORMERS
3—200 KVA 600/220/110

MOTOR GENERATOR
1—100 KW 550/125V

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The Buyer Must Be Satisfied—Always

. . . INSPECTED & GUARANTEED CERTIFIED READY FOR USE

A. C. Motors, 3 phase, 60 cycle

Qu.	H.P.	Make	Type	Volts	Speed
4	½	G.E.	KT	220/440	1800
2	½	West.	CSA	220/440	1200
7	½	Gen. Elec.	K	110	1800
10	½	Gen. Elec.	KT	220/440	3600
6	1	G.E.	KT	220/440	1800
3	1½	Cr. Wh.	SC-224B.B.	220/440	1800
3	2	Allis Chal.	AN	220/440	1200
3	3	West. (new)	CS-254 B.B.	220/440	1200
5	5	Gen. Elec.	K-264	220/440	1800
5	10	Allis Chal.	AN	220/440	1200
5	15	Allis Chal.	AN	220/440	1200
1	15	Gen. Elec.	KT-522	220/440	720
1	20	Gen. Elec.	KT-526	220/440	720
1	20	West. sl. rg.	CW	220/440	720
3	20	Allis Chal.	AN	220/440	1800
1	20	Allis Chal.	AN	220/440	600
1	20	Allis Chal.	AN	220/440	1200
1	25	Cr.Wh.sl.rg.	Open	220/440	1200
1	25	Lincoln		220/440	1200
1	25	Al. Ch.	IK	220/440	720
1	27	Otis sl. rg.		220/440	600
4	30	Allis Chal.	AN	220/440	1200
2	30	West.	CS	220/440	720
2	30	Gen. Elec.	KT	220/440	900
2	35	Allis Chal.	AN	220/440	1200
2	35	Gen. Elec.	I-K	220/440	900
1	60	Sprague s.rg.	IQ	220/440	720
1	100	Al. Ch.		220/440	900
1	400	A. Ch. sl. rg.		2200	1800
1	800	G. E. sl. rg.		2200	443

A. C. Motors, 3 phase, 25 cycle

2	½	West.	C	220/440	750
5	5	Gen. Elec.	KT-181	220/440	750
5	7½	G.E. sl. rg.	MT	220/440	750
3	10	G. E. sl. rg.	I	220/440	750
2	10	West.	CS	220/440	500
3	15	Gen. Elec.	I	220/440	750
1	15	Howell b. b.	SCR	220/440	500
1	20	Wagner	BP	220/440	750
1	20	West. sl. rg.	CW	220/440	750
1	25	Burke sl. rg.		220/440	750
1	25	Gen. Elec.	IK	220/440	750
2	40	Gen. Elec.	KT-533S	550	1500
1	250	Gen. Elec.	I	220/440	1500
1	200	West.	CS	220/440	750
1	200	Gen. Elec.	IK	220/440	750
1	150	Gen. Elec.	IK	2200	500
1	40	Burke syn.	AC-8	220/440	750
1	100	West.	CCL	220/440	1500
1	225	G. E. sl. rg.	ITC	220/440	500
1	1000	Gen. Elec.	I sl. rg.	2200	300
1	900	West. syn.		2200	185

1—600 H.P. Chalmers Slip Ring, 3 ph. 25 cy., 2300 V. 295/300 RPM, Type ANY, Rolling mill duty, 3 brg. complete.

WELDERS

12—400 ampere Lincoln Welders, 3 phase, 60 cycle, 220-440 volts.
3—300 ampere Lincoln Gas Welders driven by 6 cycle Hercules engine.

FREQUENCY CHANGERS

1—120 K.V.A. Frequency Changer 25 to 60 cycle.

AIR COMPRESSORS

2—Ingersoll Rand Air Compressors, imperial type XCB, 20 x 12½ x 16, 1200 C.F.M., 100 lbs. pressure, belt drive by 200 H.P., 3/25/2300 volt motors, complete with starters.

TRANSFORMERS

1—10,000 K.V.A. Pittsburgh 13,200 volt primary 4,600 volt secondary, 3/60 Delta, Delta connected.

M. G. Sets

2—200 KW Allis Chalmers 125 V DC 25 or 60 cy. dr.
1—75 KW, 125 volt D.C. motor driven 115 H.P., 3/25/2200/750 with A.C. & D.C. Panel.
1—30 KW, General Electric 250 volt DC mounted on Factory base, driven by 50 H.P., General Electric, 25 cycle motor.

1—3 Ton Electric Furnace, complete with transfs. panels and ladles, 25 cycle.

Volland ELECTRIC EQUIPMENT Company Incorporated

1512 NIAGARA ST. Phone Grant 2715 BUFFALO 13, N. Y.

3000 KW TURBO-GENERATOR

GENERAL ELECTRIC TYPE A. T. B. CLASS 4 NO. 400097

Generator data

Rating: 3000 KW Speed: 1800 R.P.M.
Volt: 2300 Cycles: 60 Phase: 3

Turbine data

Curtis form H.

Steam entering 180 to 200 P.S.I. gauge and 125° super heat.

Steam exhausting to condenser at 26" Hg. min. vacuum

Auxiliaries

Wheeler surface condenser 9000 sq. ft.
Vacuum pump, condensate pump, circulating pump and exciter each with steam or motor drives as required.

Operating characteristics

Temp. rise normal load.....40°
Field current normal load.....195 amp
Combined copper, core and windage losses normal load .....126 KW
Steam economy normal load.....17.3 lb.
Overload capacity 25%

1000 KW TURBO-GENERATOR

WESTINGHOUSE PARSONS NO. 548145

Generator data

Rating: 1000 KW Speed: 1800 rpm Volt: 2300 Cycles: 60 Phase: 3

Turbine data

Shop No. 473 Steam entering 125 psi gauge and 100° superheat Steam exhausting to condenser at 26" Hg. min. vacuum

Auxiliaries

Worthington surface condenser 2500 sq. ft.
Vacuum pump, condensate pump, circulating pump, exciter

Operating characteristics

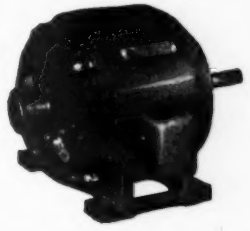
Steam cons. normal load.....13.1 lb.
Generator eff'y. normal load.....91.9%
Overload capacity .....25 %

General Machinery LTD

GRANVILLE ISLAND, VANCOUVER, B.C. Tel.: PAcific 3487

NOW—NEW UNITS FOR PROMPT DELIVERY

Now, as a result of Chicago Electric's far-sighted buying policy, the following units are offered for immediate delivery. New equipment in stock and on back-orders assure prompt, certain satisfaction, in answer to your procurement problems. Write today, for the current Chicago Electric Bulletin, and quotations.



NEW A.C. MOTORS

Qu	HP	Make	Type	RPM
1	200	Westghse	CS	1800
1	60	Gen.Elec.	K444	1800
20	50	Gen.Elec.	K405	1800
1	50	Gen.Elec.	K445	1200
3	40	Gen.Elec.	K404	1800
3	40	Gen.Elec.	K444	1200
3	30	Gen.Elec.	K365	1800
2	30	Gen.Elec.	K405	1800
3	30	Gen.Elec.	K444	1200
4	25	Gen.Elec.	K364	1800
4	25	Gen.Elec.	K404	1200
1	20	Gen.Elec.	K364	1800
3	20	Gen.Elec.	K365	1200
3	20	Gen.Elec.	K404	1200
1	20	Westghse.	CS	900
8	15	Gen.Elec.	K365	1200
6	10	Sterling	NEMA	1800
14	7.5	Gen.Elec.	K284	1800
1	7.5	Sterling	NEMA	900
4	5	LouisAllis	OCS225	3450
2	5	Gen.Elec.	K254	1800
25	5	Westghse.	CSP254	1750
14	5	Hertner		1800
3	5	Gen.Elec.	K284	1200
10	3	LouisAllis	OGS224	3450
5	3	Brwn&Brck.	PM225R	1800
2	3	Gen.Elec.	K254	1200
1	3	Westghse.	CS	720
1	2	U.S.	204	3450
2	2	Gen.Elec.	K224	1750
11	2	Gen.Elec.	K225	1200
3	2	Gen.Elec.	K225	1140
9	1.5	Gen.Elec.	K204	TENV
4	1.5	Sterling	NEMA	1800
1	1	NewReuland	MC203	1800
125	1	Brwn.&Brck	PM203	1750
4	1	Reuland	ML203	1200
87	.75	LouisAllis	OGS163	1750
6	.75	Reuland	ML203	1200
1	.75	Gen.Elec.	K203	1200
1	.75	Brwn.&Brck	PM720R	1750

NEW TRANSFORMERS

Sorgel—Type S

Qu.	Kva.	Rating
3	25	480/240-240/120
1	20	460/230-230/115
1	15	460/230-230/115
1	10	460/230-230/115
1	5	480/240-240/120
2	3	480/240-240/120
4	2	480/240-240/120
5	1.5	460/230-230/115
9	1	460/230-230/115
12	.75	460/230
4	.5	480/240-240/120

D.C. GENERATORS

Qu.	Kw.	Make	Type	Volts	RPM
1	100	Allis Chlrs	MCW	120-240	1200
7	25	Crocker Whlr.	CDC	120	1200
73	20	Bogue	MC1	125	1200
5	1.5	Elec. Mchy.	1Brng.	Xct. 125	1200

A.C. GENERATORS

Century—ARC

Qu.	Kva.	Character	RPM	PF
1	15	3/60/208	1200	.8
4	9.4	1/60/120	1200	.8

NEW COMPENSATORS

Q.	Hp	Make	Type	Rating
6	200	Gen.El.	CR1034-K33-3	3/60/440
6	150	Gen.El.	CR1034-K1	3/60/440
3	125	Gen.El.	CR1034-K33-3	3/60/220
5	100	Gen.El.	CR1034-K1	3/60/440
3	100	Gen.El.	CR1034-K33	3/60/220
4	100	Cutler Hammer Bull	9141-H1363F	3/60/220
1	75	Cutler Hammer Bull	9141-H1362	3/60/220
2	75	Gen.El.	CR1034-K1	3/60/440
6	75	Gen.El.	CR1034-K1	3/60/220
6	60	Gen.El.	CR1034-K1-2	3/60/440
4	60	Gen.El.	CR1034-K1-2	3/60/220
1	50	Cutler Hammer Bull	9141-H1311C	3/60/220
6	50	Gen.El.	CR1034-K1X	3/60/220
6	50	Gen.El.	CR1034-K1X	3/60/440
6	40	Gen.El.	CR1034-K1	3/60/220
2	30	Gen.El.	CR1034-K1-B	3/60/220
3	20/25	Gen.El.	CR1034-K1	3/60/220

In addition to listed equipment, a selection of new Hoisting Equipment, Grinders, Pumps, Compressors, and gas and diesel engines is stocked, write for details

Chicago Electric Co.

WRITE TODAY — 1320 WEST CERMAK — CHICAGO 8, ILLINOIS

REBUILT POWER EQUIPMENT

READY TO SHIP!

ALTERNATING CURRENT MOTORS

3 ph., 60 cy.

H.P.	Make	Volts	R.P.M.	Type
7½	Westg.	220	1200	CS-Sq. Cg.
7½	Lincoln	220	900	Sq. Cg.
10	G.E.	220	1200	MT-Slipring
25	Westg.	220	570	Sq. Cg.
35	Westg.	440	680	CCI-Sq. Cg.
35	G.E.	220/440/2200	865	I-Slipring
40	G.E.	440	1200	KT-Sq. Cg.
40	Reliance	220/440	670	Sq. Cg.
50	Lincoln	220/440	1050	Sq. Cg.
75	Westg.	220/440	900	CS-Sq. Cg.
100	Flynn Welschel	220/440	900	31V-RN Sq. Cg.
100/125	Cr. Wh.	220/440	1200	Sq. Cg.
200	Cr. Wh.	440	505	SR-Slipring
200/250	Westg.	220/440	1800	CW-Slipring
400	Westg.	2200	435	CW Slipring

COMPRESSORS

2—315 cu. ft. 100# pres. Ingersoll Rand Models 315 and 315A Portable Air Compressors with 105 HP. Waukesha Oil Engines complete with accessories.
1—610 cu. ft. 100# pressure Burry Horiz. Compressor.

VARIABLE SPEED MOTORS

230 VOLT D. C.

H.P.	Make	R.P.M.	Type
25	Westg.	600/1200	SK
25	Westg.	325/975	S
20	Westg.	625/1200	SA
10/15	Electro Dy.	600/1200	
10	Westg.	800/1600	SA
10	Cr. Wh.	690/895	CMC
10	J. C. Curran	950/1230	
10	Westg.	400/1600	SA
10	Sprague	625/1250	LC
4	G.E.	850/1700	LC-8
3	Both	500/1000	RS

SERIES WOUND MOTORS

H.P.	Make	Volts	R.P.M.	Type
175	G.E.	230	475	MD
80	Westg.	220	450	76-A
68	G.E.	220	495	CO-2007
50	Northern	220	600	K
35	Westg.	230	550	49D
32	Shaw	230	485	5L2F
7½	Westg.	230	975	S
3½	Westg.	230	1200	L

230 VOLT DC MOTORS

H.P.	Make	R.P.M.	Type
1/6	Bodine	3400	
¼	Triumph	525	14-F
1½	Master	3450	DM
1	Westg.	1750	SK
2	Westg.	1725	SK
3	Westg.	1725	SK
3	Western Elec.	1125	E-20-R
3½	Westg.	975	S
4	G.E.	850	LC-8
5	Westg.	1150	SK
5	Westg.	1150	SK
7½	Westg.	1150	SK
7½	G.E.	1700	RC
8	G.E.	950	RC-11
10	Cr. Wh.	850	CM
10	Westg.	1750	SK
12	Northern	1475	
15	Allis Chal.	800	
15	Westg.	1700	SK
20	Westg.	1750	SK
20	Westg.	600	M
20	Westg.	975	S-6
25	G.E.	650	MD
25	Westg.	825	SK13
25	Westg.	1150	SK
200	Cr. Wh.	600	CCM

MOTOR GENERATOR SETS—

1—150 KW. 500 v. compound wound Ridgway Generator 900 rpm. direct connected to a 225 HP. 2200 v. 3 ph. 60 cy. Ridgway Synchronous Motor.
1—100 KW. 900 rpm. 550 v. Westg. Generator coupled to a Westg. 2300 v. 3 ph. 60 cy. synchronous motor.
1—15 KW. 1150 rpm. 115/230 v. DC Westg. Generator direct driven by 20 HP. 220 v. 3 ph. 60 cy. type CS motor.
1—12½ KW 110/220 v. single ph. 60 cy. 1800 rpm. Burke Electric AC Generator with a 20 HP. 230 v. DC motor.
1—35 KW. 1200 rpm. 125 v. DC type S. Westg. Generator driven by a 54 HP. 220 or 440 v. 3 ph. 60 cy. type CCL Westg. induction motor.
1—75 KW. 250 v. compound wound Westg. Generator direct connected to a 100 HP. 3 ph. 60 cy. 220 or 440 v. Fynn Welschel synchronous motor.

INDUSTRIAL TRUCKS

5—Automatic type LO-5 Low Lift Trucks capacity 5 ton, platform type. Equipped with towing coupler and bumper for pushing cars.
5—New 4 ton Yale & Towne model YSW Multi-Stroke Hand Lift Platform Trucks.

PUMPS

1— 130 gpm. 50 ft. head Rayton Dowd Pump.
1— 378 gpm. 44 ft. head Dayton Dowd Pump.
1— 400 gpm. 75 ft. head Allis Chalmers Pump.
1— 600 gpm. 32 ft. head Dayton Dowd Pump.
1— 750 gpm. 20 ft. head Dayton Dowd Pump.
1— 750 gpm. 70 ft. head Dayton Dowd Pump.
1—1200 gpm. 110 ft. head Allis Chalmers Pump.
1—1500 gpm. 90 ft. head Allis Chalmers Pump
1—3500 gpm. 90 head DeLaval Pump.
1—4000 gpm. 138 ft. head Ingersoll-Rand Pump.
1—8000 gpm. 100 ft. head American Well Works Pump.

WRITE, WIRE OR PHONE YOUR ELECTRICAL NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

Write—Wire—Phone

us if you don't see the item you need. This listing is only a part of our large stock.

M-G SETS

Others available—special units built to order.

225 KW G.E. MPC gen. DC 125 V. coupled to 350 HP Whse. synch. motor 3/60/440 V. 900 RPM.
150— KW Gen. Elec. type MPC gen. DC 125 V. coupled to 225 HP sq. cage motor 3/60/2200 V. 1200 RPM.
150 KW G.E. MPC gen. DC 250 V. coupled to 225 HP sq. cage motor 3/60/440 V.
75 KW Cr. Wheeler 65 H gen. DC 125 V. coupled to 100 KVA synch. motor 3/60/440 V.
60 KW G.E. C.D. gen. DC 60 V. 1000 amp. coupled to 90 HP synch. motor 3/60/220/440 V.
37½ KVA Whse. AC gen. 3/60/240 V. coupled to 50 HP Whse. SK motor DC 230 V. 1150 RPM. 3 brg.
2—10 KW Whse. like new, DC 250 V. output, AC motor 3/60/220/440 V.

D. C. MOTORS

H.P.	Mfg.	Type	Volts	Speed
125	Cr. Wheeler	125H	230	500
100/150	G.E. dynamos.	TLC	250	1000/3500
75	Whse.	S136	125	475
65	G.E. Northern	C	230	375/750
60	Diehl dynamos.	R10	250	500/2000
60	G.E. b.b. TEFC	CDM103	230	1750
50	Burke		230	350/1000
50	G.E. Sprague	LC	250	700
50	Cr. Wheeler (5)	50H	230	700
40	Allis Ch.	E120	230	1150
40	Roth	S	115	850
35/50	Gen. Elec.	CD123	230	575/1150
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
25	G.E. b. b. New	CD93	115	1150
20	G.E. b.b. New(2)	CD83	115	1750
20	Reliance	T	230	850
20	Imperial int. dty.	D37	230	1200
20	Gen. Elec.	LC	230	575
20	Gen. Elec.	DLC	230	500/1500

SLIP RING MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfg.	Type	Speed
1	400	Gen. Elec. 3 brg.	I-P	450
1	300	Whse.	HF	400
1	300	Burke	EMV	225
1	250	Whse.	CW	450
1	200	Gen. Elec.	I-M	1800
1	200	G.E. 2200 v.	I-M	360
1	200	Whse. 3 brg.	HF	600
1	100	Gen. Elec.	I-M	600
1	75	G.E. 2200 v.	I-M	1800
1	75	F. Morse 2200 v.	BV	1800
1	50	Gen. Elec.	I-M	600
1	50	F. Morse b.b.	HV	1200
1	40	Gen. Elec.	M546	514
2	40	Allis Ch.	ANY	450
1	40	G.E. 550 v.	MT536	900
2	37	G.E. int. duty	ITC	1200
1	37	G.E. int. duty	ITC	600
1	35	Lancashire b.b.	late	1800
1	30	Gen. Elec.	MT346	600
2	30	Gen. Elec.	OMT 336	1200
1	25	G.E. int. duty	ITC	1200
1	25	G.E. 2200 v.	I-M	900
1	25	Gen. Elec.	I-M	600
1	60	Ideal 2200/4000 v.	A	1800
1	25	Gen. Elec.	MT326	900
1	15	Watson	KHV	720
4	10	Century New b.b.	SRT326	1200

SYNCHRONOUS MOTORS

H.P.	Mfg.	Type	Volts	Speed
750	Allis Ch.		220/440	1200
225	KVA Gen. Elec.	ATI	220/440	900
200	Elec. Machy.		220/440	600
100	KVA Cr. Wheeler		220/440	900

324 H.P. Jones Speed Reducer

Ratio 5.2 to 1, size 240 SHS, New

Also many speed reducers and gear motors in stock up to 15 HP.

CENTRIFUGAL PUMPS

8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm 230 ft.
8" Worthington, 2000 gpm @ 200 ft.

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1	200	Gen. Elec.	I-K	600
1	125	Northwn.	H	1800
1	60	Ideal	A	1200
2	50	Louis Allis New b.b.	OA	1800
1	50	Whse.	CCL	900
1	50	Gen. Elec.	I-K	720
2	35	Gen. Elec.	I-K	720
1	30	Whse.	CS	900
2	30	Howell b.b. 4 spd.	SC	1800
2	35	Allis Ch. b.b.	AR	1200
1	20	F. Morse	BH	900
2	20	Whse. New b.b.	CS384	1800
2	50	Whse. 2200 v. vert.	CS	900
1	40	Gen. Elec.	I-K	900
1	40	Allis Ch. 3 spd.	ARX	900/600/450
1	30	Whse.	CCL	600
1	30	Whse 2200 v.	CS	1800
2	25	Allis Ch.	AN	900
2	25	Gen. Elec.	I-K	720
1	25	Gen. Elec.	I-K	600
2	20	Gen. Elec.	KT312	1200
2	20	Century b.b. 4 spd.	SC504	1800

25 CYCLE MOTORS

H.P.	Mfg.	Type	Speed
450	Whse. 2200 v.	CW sl. rf.	750
150	Whse.	HF sl. rg.	500
100	Whse.	CCL sq. cg.	500
75	Gen. Elec.	I sq. cg.	750
50	Allis Ch.	ANY sl. rg.	1500

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Gen. Elec. 1	MPC	125/170	1150
100	Fair Morse	TR	250	800
75	Whse.	S	125	600
50	Cr. Wheeler	CCD	250	850
30	Lincoln b.b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
20	Allis Ch. (2)		125	475

60 CYCLE A.C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
750	Allis Ch.		440	1200
400	G.E. 3 brg.	ATB	2300	514
225	Gen. Elec.	ATB	240/480	900
165	Elec. Machy.	BRKT	240/480	900
150	Allis Ch. 25 cycle		240/480	500
150	Allis Ch.	B	2300	900
100	Cr. Wheeler	ped.	240/480	600
31	Whse. b.b.	late	120/208	1200

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET **CHICAGO 7, ILL.** **MONroe 7409**

FOR SALE—TO HIGHEST BIDDER

WONDERFUL BUY OF FOLLOWING EQUIPMENT AND MATERIALS

We reserve the right to accept or reject any bids that are made

1—**ALLIS CHALMERS Slip Ring Motor** #2K1356601—250 HP, 870 RPM, 220 Volt, 3 ph., 60 cycle, 59 Amp. Electrically OK. Rings need repair.
1—**GENERAL ELECTRIC Slip Ring Motor** #1180131—150 HP, 720 RPM, 2200V., 3 ph., 60 cycle, Form M, 36 Amp. Runnable.
1—**WAGNER Slip Ring Motor** #336186—100 HP, 685 RPM, 2200 V., 3 ph., 60 cycle, 27 Amp., Type 31X5BP Runnable.
1—**WESTINGHOUSE Electric DC Motor** #2592064—25 HP, 600 RPM, 230 VDC—92 Amp. Armature needs rewound.
1—**WESTINGHOUSE Electric Slip Ring Motor** #1865865—200 HP, 514 RPM, 2200 V—3 ph., 60 cycle, 50 Amp., Type CW Form 1002. Stator needs rewound.
1—**CROCKER-WHEELER DC Motor** #561875—5 HP, 1750 RPM, 230 VDC, 18.5 Amp. Electrically OK.
1—**WESTINGHOUSE ELECTRIC DC Motor** #233501—30 HP, 975 RPM, 230 VDC, 119 Amp. Electrically OK.
1—**GENERAL ELECTRIC AC Motor** #1053934-25 HP, 1200 RPM, 220 VAC, 3 ph., 60 cycle, 61 Amp., type KT 326. Electrically OK. Trying to trade.
1—**GENERAL ELECTRIC—AC Motor** #694784—10 HP, 1800 RPM, 220 VAC, 3 ph., 60 cycle, 24 Amp., type KT Form C. Electrically OK. Trying to trade.
1—**GENERAL ELECTRIC Syncronise Motor** complete with motor driven excitor and all starting equipment—#5636420—300 HP, 360 RPM, 2200 V—3 ph., 60 cycle, Type T3 Form HL. OK. Purchased from Duquesne Electric & War Assets.
1—**ALLIS-CHALMERS Slip Ring Motor** #5082-K-Y-41C—150 HP, 695 RPM, 2200 V, 3 ph., 60 cycle, 36.5 Amp. Electrically OK. (#11 Beater Motor).
1—**HAWTHORNE ELECTRIC D.C. Motor** #328843—15 HP, 925 RPM, 230 VDC, 55.8 Amps., Type 1-VC-1. Needs Rewound.
1—**WORTHINGTON Pump Head Motor** #GC3495—5 HP, 3425 RPM, 230 VDC, 20 Amp., Type DM Frame 6240. Electrically OK.
1 **WESTINGHOUSE ELECTRIC DC Motor** #2-5T-97B—4 HP, 1175 RPM, 220 VDC, 17 Amp., Type S. Electrically OK.
1—**WESTINGHOUSE ELECTRIC DC Motor** #112692—5 HP, 1300 RPM, 230 VDC, 21 Amp., Type S. Electrically OK.
1—**MASTER ELECTRIC Gear Head Motor** #G.E.863—1 HP—1725 to 96 RPM, 230 VDC, Form DM Frame 4060 Style 35592. Electrically and mechanically OK.
1—**GENERAL ELECTRIC DC Motor** #T4554—7-1/2 HP, 850 RPM, 230 VDC, 30.2 Amp., Form A24 Type RC. Needs Rewound.
1—**ROBBINS & MYERS Electric Hoist.** #H1489—1/2 Ton Type L 1/2 DB, 230 VDC. OK.
1—**WRIGHT ELECTRIC Hoist** #54879—1/2 Ton Type LR 1/2, 230 VDC. OK.
1—**SHEPPARD LIFT-About-Hoist** #25-1-1-502-1 ton type 21-4, 230 VDC. OK.
1—**DETROIT ELECT. HOIST.** Capacity 1 ton—230 VDC. OK.
1—**YALE Elect. Chain Hoist.** Md. 20B—1 ton, 230 VDC. OK.
3—**GENERAL ELECTRIC Oil Circuit Breakers.** Ty. FK20. OK.
4—**GENERAL ELECTRIC** Drum Controllers. T108A. OK.
3 sets—5000 V, 3 pole S.T. **Disconnect Switches.**
1—**WESTINGHOUSE Drum Controller** #583256. Needs Repairs.
1—**WESTINGHOUSE DRUM Controller** Type 20B. OK.
6 sets—Starting resistance **Cast Iron Grids.**
120—**SYLVANIA Heater Lamps** Type R4D—115V. Orig. Cartons.
1—**WESTINGHOUSE ELECTRIC DC Automatic Starter** Style 4PT Series, 15 HP, 230 VDC.
1—**TURBINE Generator**—This is General Electric alternating current generator #636889, type ATB 2-2500-3600, Form 1, 620 amp., 2000 KW, 2300 V. 3600 RPM Direct coupled to one General Electric DC Excitor, #62196, type ED-2-17-36 Form T, 125 V., 136 amp., 3600 RPM. Driven by one Curtiss Steam Turbine #13802, 2000 KW, 3600 RPM, Form G, 140 lb., steam, condensing pump.
C. H. Wheeler Mfg. Pump #12394, driven by one G. E. Induction Motor #1304249, type KT 180-4-7½-1800, Form C, 2200 V., AC 3 ph., 60 cy.
Complete with G. E. Starting Compensator CR 10 type NR 1606, Form H, 2 PL, 220 V., 3 ph., 60 cy., and one Bulldog Electric Switch 53322 D.
This Turbine Generator outfit is complete with C. H. Wheeler Surface Condensor, all the necessary meter switch gear and voltage regulator. Also has surface Condensor.
3—**ILG Ventilating Fans** 1/4 HP, 230 V. DC, 855 RPM. Formerly used for exhausting air from plant. Capacity of 500 cu. ft. per minute.
2—**General Electric CP27 Compressor Head Air Pumps** 230 V. DC complete with pressure line switches. These are good for 100 lbs. pressure at 300 cu. ft. per minute.

TARENTUM PRODUCTS CORPORATION

TARENTUM, PENNSYLVANIA *Contact* **Mr. J. V. Mason** *Telephone* **Tarentum 1470**

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 phase—25 cycle—220/440 volts

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West	CS		750
5	West.	CS	453	750
5	West	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871.52C	1460
125	West. (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

3 phase, 60 cycle—220/440 volts

H.P.	Make	Type	RPM	Serial No.
40	General Electric	I-K	1800	73318
40	Westinghouse	MS	1800	1506806
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
40	General Electric	I-K	1800	73316
40	Westinghouse	CCL	1800	1506800
40	General Electric	I-K	1200	181444
50	Westinghouse	CS	1800	1949877
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	General Electric	14	1800	181444
50	General Electric	KT-352	720	
50	Allis Chalmers		1800	3K28825
60	Reliance		1200	B11458
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Whse. 2200V.	CCL	1200	854121
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CCL	1200	
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CS	1200	2318625
125	Westinghouse	CCL	1800	765231
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	General Electric	I-K	1200	
150	Whse. 2200V.	CCL	720	808349
150	Westinghouse	CS	1800	2429726
250	General Electric	I-K	600	2246834

230-VOLT D.C. VAR.

H.P.	Make		Type	RPM
1½	Westghse.	(9)	SK	740/2200
1½	G.E.		RA6	500/1500
1½	Westghse.		SK	1150/2200
2	G.E.		RC24	2040
2½	G.E.	(2)	RA30	400/1350
2½	Westghse.		SK	450/1800
3	G.E.	(5)	CD55	850/1350
3	G.E.		CD	850/1350
3	G.E.		DD55	850/1350
3	G.E.		CD	850/1350
3½	Westghse.		SK	450/1600
3½	Westghse.		SK	450/1800
3½–4½	Westghse.	(4)	SK	175/1800
3½	Sprague		M2 Crane	655
3½–5½	Westghse.	(2)	SK	507/1500
3½–7½	Westghse.	(2)	SK	450/1500
3½–6¾	Westghse.	(4)	SK	450/1500
3½–7½	Westghse.		SK	450/1500
5	Star		SB3	1150
5	Westghse.		SK	1600/2800
5	Reliance			500/1000
5	G.E.		RF9	450/1800
5	G.E.		CD55	1750
5½	Westghse.	(22)	SK	500/1500
5	Westghse.		SK	500/1500
5½	Westghse.		SK	400/1600
7½	Westghse.		SK	500/1500
7½	Westghse.	(4)	SK	1340/2680
7½	G.E.		CVC113	1675
7	G.E.		RF10	400/1600
7½	G.E.		CD55	1750
10	Westghse.			1200/1800
10	G.E.		LC	750/1200
10	G.E.	(3)	LC	750/2000
10	G.E.			425/1275
10	G.E.			400/1200
15	G.E.		1026	800/2700

SPECIAL

1—150 HP. Fairbanks Morse Ball Bearing Motor. 3/60/440/1800 RPM.
1—75 HP. Fynn-Weischel (Wagner) Synchronous Motor Serial #345781, 3 Phase 60 Cycle 440 Volts, 1200 RPM.

NEW MOTORS

100—New motors from ½ HP. to 30 HP. in stock. 60 Cycle single and 3 Phase.

ROTARY CONVERTOR

1—2000 KW. Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

AIR COMPRESSORS

2—5000 CFM. Worthington 45# low pressure. Complete with 500 HP. Gen. Elect. Synchronous motors, 3 Ph. 25 Cy. 2300 Volts.

PRIMARY CONTROLS

2—200 Amp. Conrad-Schweitzer 3 Pole Fused Load Breaks, 2300 V.
2—150 HP. Westinghouse oil type magnetic contactors, 3/60/2300 V.
1—225 HP. Square D, oil type magnetic contactor, 3/60/2300 V.

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CL. 4758

COMPLETE COAL HANDLING— COAL STORAGE SYSTEM

100 Ton/Hr. Link Belt Conveyor—Grinders—Scrapers, etc., for 20,000 Ton Storage. All supporting steel—motors—screens—belts—complete

(A) Track hoppers with girders for two track siding.
(B) 2-Apron feeder conveyors 30' and 20' from hopper pit.
(C) Dragline (scraper) coal storage system about 200'x150' with winder, scraper, controls.
(D) Drag operators house with crusher housing, all steel—crushers, controls, etc.
(E) Conveyor section #1, 20" troughing conveyor, from crusher pit to junction tower. 182' at 16° incline from elevation minus 10' to plus 36', steel housing and walkway.
(F) Junction tower 12'x18'x46' high with controls, etc.
(G) Conveyor section #2, 20" troughing conveyor, from junction house to boiler house. 185' at 12° from elevation 26' to 67', steel housing and walkway.
(H) Conveyor section #3, 20" troughing conveyor, over bunkers about 185', 24" diameter heavy duty magnetic head pulley.
(I) Automatic self-propelled self-reversing belt tripper.

105 carrying idlers—3 pulley troughing type 5" diameter on 5' centers.
53 return idlers 5" diameter on 10' centers.

20 TON—SHAW BOX—OVERHEAD CRANE

Motor operated hoist—hand bridge and trolley traverse. Crane Span 30'6", lift 30'60", hoist speed 5 feet/minute. Hoist motor 10 HP, 60 cycle, 3 phase, 440 volts. Runway and track 160', complete with supporting steel for power house operation.

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125 Volts D. C. Motors
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550 Volt D. C. Motors

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1—60 HP Chicago Pneumatic horizontal, semi.

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1—200 HP Worthington, 4 cylinder, full diesel.

Several with
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We buy and sell all types of Pumps, Compressors, Boilers, Processing Equipment and Conveyors.

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1500 H.P.—1250 KVA
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1500 KW. 3/60/600 v. Cond. 250# new 1940, available August 1947.
300 KW. 3/60/240 v. Non Cond. 150# 5-10# back pr. A-1 immediate delivery.

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave, New York 33, N.Y.

SCOTCH BOILER

60 HP, 125#, new 1941; return pump, high and low water control Ray oil burner and smoke stack.

F. W. HAY & COMPANY
2734 Cherry St., Kansas City 8, Mo.

Turbo Generator, G. E. Automatic Extraction. 933 KVA 220/440 Volt. 60 cycle. 3 phase.

Steam Engine with alternator direct connected 100 K.W. 220 volt 3 phase, 60 cycle.

Motors, 3 Phase 60 Cycle 220 Volt, 1140 and 1750 RPM. All sizes, ½ to 30 H.P.

Gasoline Storage Tank, 18,000 gallon.

Aluminum Corrugated Roofing, new

Aluminum, Flat Sheets, Soft, new

Condensers, 2000, 1500 and 1000 sq. ft.

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A. C. GENERATORS 3 PHASE—1 PHASE 15 to 62½ KVA

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SLIP RING MOTORS

3-PH., 60 Cy.

HP	Volts	Make	Speed
300	440	Al. Chal.	900
250	2300	G.E.	600
350	440/550	G.E.	600
200	2200/440	G.E.	600
150	2200/440	G.E.	600
125	440/220	G.E. (Houst)	900
100	440/220	G.E. MTC	900
100	550	G.E.	900
80	440/220	G.E. (MTC)	900
75	440/220	G.E. (MTC)	600
60	440/220	G.E.	1200
50	2200/440	G.E.	600
75	550	G.E.	900
40	2200	Whse.	900

SYNCHRONOUS MOTORS

3-PH., 60 Cy.

JHP	Volts	Make	Type	RPM
600	4000/2300	Cr. Wh.	SYN.	900
500	4000/2300	Cr. Wh.	SYN.	900
500	440/220 v.	G.E.	TS	900
300	440/220	G.E.	ATI	600
300	4150/2300	Cr. Wh.	SYN	900
300	440/220	Al. Ch.		600
250	4000/2300	G.E.	TS	1200
240	2200	G.E.	ATI	600
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
125	2300	G.E.	TS	327
110	440/220	G.E.	TS	1800
100	440/220 25 cy.	G.E.	TS	375
100	440/220	Whse.	G	1800
90	440/220	G.E.	ATI	1200

OUTDOOR OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-132 General Electric, 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's Pt's, etc.

1—New 2500 amp., DA 75, Whse., 3 pole, air type circuit breaker, indoor

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G	K	1200
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
350	440	G.E.	IK	900
300	440/220	G.E.	IK	720
200	440/220	Whse.	CS	600
200	440/220	G.E.	KT	600
200	2200/550	Al. Ch.	AR	900
150	440/220	Howell	B. Brg.	1800
125	2200	G.E.	KT	600
100	440	G.E.	IK	450
100	2200	G.E.	KT	511
75	2200	G.E.	IK	1800
74	2200	G.E.	KT	900
50	2200	Al. Ch.		720
50	550	Whse.	CS	3600

A. C. GENERATORS

1—450 kva., 900 rpm., 440/220 v., G.E.
1—450 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 900 rpm., 4000/2300 v., Cr. Wh.
1—300 kva., 600 rpm., 440/220 v., G.E.
1—225 kva., 600 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 pm., 440/220 v., G.E.

MOTOR GENERATOR SETS

1—100 kw., 250 v., 900 rpm. Whse., conn. to 150 hp. 2300 v., 60 cy., sq. cage motor.
1—60 kw., 250 v., 1200 rpm. G. E., conn. to 90 hp. 440/200 v., 60 cy. syn. motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—35 kw., 120 v., 1800 rpm. G.E., conn. to 50 hp. 440/220 v., 60 cy., squirrel cage.

TRANSFORMERS

60 Cycle

1—150 kva. Whse. SK, 13200-125/215 v. 3 ph.
3—150 kva. G.E. H-K, 2400/4800-240/120 v.
3—150 kva. Whse. SK 11000-2300 v.
3—150 kva. Whse., 11000-2300 volts.
2—100 kva. Whse., SK, 4800/2400-240/120 volts.
3—100 kva. Whse., SK, 2400-120/240/480 v.
3— 50 kva. G.E. DRY, 460-115/230 v.
3—37½ kva. G.E., H-K, 2400-440 volts.
2—37½ kva. Kuhlman, 2400-480 volts, 3 ph., NEW.
6— 25 kva. G.E. DRY, 2400-120/240 v.

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50 H.P. —48"x10'—125# W.P.
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20 H.P.—36"x8'—100# W.P.
15 H.P.—36"x6'6"—100# W.P.
2½ H.P.—20"x3'6"—100# W.P.

Complete with Base, Grates, Hood and Standard Steam Trimmings.

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500—Used G. E. Pole Type D. & W. oil fuse cutouts, 10 to 100 Amps., 2500 V...$30.00 each
1000—New Donut type inserted primary type current transformers, 250: 5 amp. 25/125 cy., for all instrument use.....$8.00 each
8—G. E. Type FKR 255-250 Circuit Breakers, 600 Amps., 3 Pole, 15,000 V. indoor, solenoid operated, frame mounted.
2—G. E. Type FHKO-39-3685 Circuit Breakers, 3000 Amps. 25,000 V. 3 pole, outdoor, solenoid operated.

We carry thousands of Breakers and Current and Potential Transformers in stock, new and used. Send us your inquiries.

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POWER EQUIPMENT

1—2250 KVA, 3 phase, 60 cy., 3600 RPM, Gen. Elec. Turbo Generator, steam pressure 410 lbs. 275° S.H. 725° T.T. with surface condensor.
1—625 KVA, 3 ph., 60 cy., 480 vlt., 900 RPM, Westgh. Generator to a Westgh. non-condensing turbine.
265 new Gen. Elec. transformers 3 to 75 KVA, 450 to 117 vlts.
68 new Gen. Elec. transformers 3300-6600-11000 to 120-240 vlts type HSBA.
1—150 K. W. 125 volts 400 RPM Crocker-Wheeler compd wound interpole Generator to a 4 cylinder, vertical unaflow Ames engine.
1—360 HP Anderson full diesel, Model 29 257 RPM with clutch and pulley on one end to drive an ice machine or any other machine and a 125 KVA, 3 phase, 60 cycle, 240 volt Generator direct connected on opposite end.
1—90 KVA, 3 ph., 60 cy., 2300 V, Fairbanks Morse Generator connected to a 2 cylinder Fairbanks Morse full diesel type Y, style VA.
1—156 KVA., 3 ph., 60 cy., 240 volt, 1200 RPM, type ATB frame 9635 General Electric connected to an 8 cylinder Buffalo Gasoline engine.
1—1000 K.W. 3 ph., 60 cy., 480 volt, 3600 RPM, General Electric Generator to a General Electric turbine 180 lbs steam pressure 40 lbs back pressure.
1—300 KW, 3 ph., 60 cy., 440 vlt. 3600 RPM Westinghouse Generator only.
7—500 amp. 6 V direct current to 3 ph., 60 cy., 220 vlt. General Electric rectifiers.
1—750 KW Gen. Elec. Extraction type Turbine 3 ph., 60 cy., 600 vlt. 150-175 lbs., 10 to 20 lbs. extraction.
1—100 KW, 125 V, type CD1247 General Electric to a 150 HP 3 ph., 60 cy., 220 vlt. type K5572 Gen. Elec. induction motor.
1—50 KW, 250 volt Gen. Elec. to a 75 HP 3 phase, 60 cycle, 440 Vlt. General Electric motor.
A large number of new 115 volt direct current ball bearing General Electric motors 5 to 20 HP.
1—1500 KW, 250 vlt., 600 RPM Westinghouse rotary converter complete with transformers and switchboard.

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NEW-USED
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2—500 KVA 60 cy., 1 ph. Allis Chalmers. 11,500—440.
1—250 KVA 60 cy., 1 ph. 7800—460.
3—75 KVA Moloney 60 cy., 1 ph. 13200—260/520.
1—100 KVA G.E 3 ph. 2300—460.

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BOILERS

2—1047 HP Heine Boilers 200#
4—1010 HP Heine Boilers 200#
2— 786 HP B. & W. Stirling 180#
2— 750 HP B. & W. Stirling 190#
1— 650 HP Casey Hedges 225#
1— 519 HP Titusville 3 drum Boiler 200#
3— 500 HP Connolley Boiler 200#—1930
2— 404 HP Springfield Sec. Header Boilers 200#
1— 400 HP B. & W. Sec. Header Boiler 160#
3— 318 HP B. & W. Stirling Boilers 200#
1— 216 HP Vogt 3 drum Boiler 160#
1— 80 HP Cyclotherm Steam Generator 125#. (New)
1— 40 HP Leffel Scotch Marine Boiler 125#

TURBINES

1—22,500 KW General Electric Condensing Turbine, Rebuilt.
1—6250 KW General Electric, 1800 RPM, Condensing, all auxiliaries.
1—750 KW, 3-60-240 volt General Electric Automatic Extraction.
1—3700 KVA General Electric Condensing Turbine.
1—500 KW General Electric Condensing Turbine
1—2000 KW General Electric Condensing Turbine.

DIESEL ENGINES

1—360 KW Chicago Pneumatic—480 Volts—New.
2—400 KW McIntosh-Seymour, 3-60-2300 volts, all auxiliaries.

ENGINE GENERATOR SETS

1—27"x36" Skinner Uniflow, direct connected to 562 KVA AC Generator, complete.
1—565 KVA Skinner Uniflow Engine Generator.
1—375 KVA Harrisburg Uniflow Engine.
1—28"x36" Hamilton Uniflow direct connected to 750 KW, 3-60-2300 volts, all auxiliaries.

MISCELLANEOUS

300 HP Kerr, 3600 Non Condensing Turbine.
2500 HP Cochrane Open Feed Water Heater.
1—150 HP Canton Ram-fed Stokers.

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325 Fincastle Building LOUISVILLE, KY.

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4—100000# Boilers 275#
1—225000# Boiler 450#
4—1000 H.P. Heine Boilers 225#
2— 825 H.P. B. & W. Sterling Boilers 200#
4— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
4— 500 H.P. Heine 200 lb. Boilers
Smaller Boilers and Fire Tube Boilers also

Several 425# and 550# Turbo-Generators available
20,000 K.W. GE Co. turbo-generators condensers
1—10000 K.W. G.E. Co., Turbo-Generator Condensing
2—3000 K.W. Turbos @ 350#
1—5000 K.W. G.E. Co., Turbo-Generator Condensing
2—2500 K.W. G.E. Co., Turbo-Generator Condensing
2—2000 K.W. G.E. Co., Turbo-Generator Condensing
1—2000 K.W. W.E. & M. Co., Turbo-Generator Con.
2—1000 K.W. G.E. Co., Turbo-Generator Condensing
2— 750 K.W. G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller Units.

Non-Condensing Turbos—300—500—750—and 1000 K. W. & Larger
CHARLES B. REARICK 30 CHURCH ST. NEW YORK

FOR SALE
HYDRAULIC PUMPS
Aldrich Pump Co. Vertical Triplex HYDRAULIC PUMPS, 2-¾" x 8", equipped with Herringbone Gears, 67.5 gpm. Maximum pressure for intermittent duty 2,200 lbs., for continuous duty 1,800 lbs. Pump and motor mounted on common bed plate. Motors are 75 HP, 3/60/220-440 volts, 740 RPM. Complete with starting panel, consisting of G. E. motorstarter switch, push button control, square "D" Switch, and capacitator. Purchased new 3-½ years ago. Excellent condition. Available for immediate delivery.
CONSOLIDATED PRODUCTS CO.
INC.
14-17 Park Row New York 7, N. Y.

BRONZE IRON PUMPS ALLOY METALS
ELECTRIC-STEAM-GASOLINE DRIVEN.
All Makes – Capacities – Pressures.
Centrifugal – Rotary – Plunger – Turbine.
MOTORS 1-2-3 PH. & D. C.
STANDARD EQUIPMENT – UP TO 200 H.P.
Generators – Welders – Dynamos.
New & Rebuilt Guaranteed Machines.
TURBO BLOWERS
SPENCER-INGERSOLL RAND-ALLEN BILLMYRE. For Heat Treating – Brazing Furnaces – Smelting – Vacuum Duty Etc.
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BOILER FEED
VERTICAL ENGINE
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ALL TYPES—CAPACITIES 1 to 1000 "CFM"
Electric – Gasoline – Steam Driven.
For Industrial – Mine Construction.
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FOR STEAM – AIR – GAS – FLUIDS.
All Makes – All Capacities – Tested.
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CAPACITIES FROM 25 to 100000 CFM.
VENTILATING – SUCTION – BLOWING
Air – Dust – Gases – Steam. Vapors.
MACHINERY
CHEMICAL & INDUSTRIAL EQUIPMENT.
ELECTRIC MIXERS-PORTABLE & STATIONARY.
SUPERIOR EQUIPMENT CO.
138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

1-75 KW M/G Set
G.E. Factory Built Generator
75V, 1000 Amps.
Motor: 115 HP Type IQ Induction
ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Philadelphia 22, Pa.

DIESEL GENERATOR SET
General Motors Diesel 12 cylinder, model 12/567, 2 cycle, 720 RPM, direct connected to: 600 KW, 500 volt D.C. Westinghouse Generator. Like new, in stock.
ALJON DIESEL CO., INC.
904-10 Pacific St. Brooklyn 16, N. Y.
Sterling 3-6515

FOR SALE Immediate Shipment From Stock
MOTORS
In excellent condition offered subject to prior sale.

Name	H.P.	R.P.M.	Volts	Cy.	Ph.	Name	H.P.	R.P.M.	Volts	Cy.	Ph.
Westinghouse	5	1130	440	60	3	Westinghouse	15	1155	440	60	3
Westinghouse	5	1130	440	60	3	Westinghouse	25	865	440	60	3
General Electric	15	1760	440	60	3	General Electric	5	865	440	60	3
Wagner Elec.	30	1720	440 or 220	60	3	Allis Chalmers	30	1760	440	60	3
General Electric	20	1760	440	60	3	General Electric	25	1740	440	60	3
General Electric	5	1150	440	60	3	General Electric	25	1740	440	60	3
General Electric	25	1755	440	60	3	Westinghouse	50	690	440	60	3
Westinghouse	25	865	440	60	3	Westinghouse	75	700	440	60	3
Westinghouse	25	1160	440	60	3	Westinghouse	75	700	440	60	3
Westinghouse	25	1160	440	60	3	Westinghouse	60	690	440	60	3
						General Electric	30	865	440	60	3

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GLAZER STEEL CORPORATION
2100 Allor Ave. Tel. 4-8601 Knoxville, Tenn.

Rebuilt Power Transformers

SINGLE PHASE—OISC

3—2000 KVA GE 13200/26000 to 2300 V.
7—4000 KVA GE 15950/27600 Y to 13800/6900 4160 V.
3— 667 KVA Packaged 23000 to 460/230 V.
6— 667 KVA 11000/22000 to 440 V.
6— 667 KVA GE 33000 to 440/220 V.
6— 200 KVA Whse. 11000 to 440/220 V.
3—2000 KVA Whse. 33000 to 11000 V.
2— 400 KVA Al. Ch. 66000/2300/4000 Y.
2—1200 KVA Whse. 66000/2300/4000 Y.
3— 333 KVA GE, 11500 to 2300 V.
3—2000 KVA 33000 to 13,200/6600 V.

THREE PHASE

1— 3000 KVA GE. 11600 to 440 V.
1— 1200 KVA Whse. 6600 Y to 2300 V.
1—15000 KVA Pitts. 27880 to 4560Y. V.
3— 450 KVA GE 66000Y to 440 V.
6— 650 KVA GE 13200 to 2300 V.

WATER COOLED

4—3333 KVA GE 25/60 cy. 6000 to 4000/6925Y/8000/13850.
3—1500 KVA Al. Ch. 33000 to 13200/6600 V.

PYRANOL

1—3000 KVA Penna. 25 cy. 13,800 to 480 V., 1 ph.
19—37½ KVA Penna. 440 V. to 220 V. 60 cy., 1 ph.

NETWORK TRANSFORMERS

19—150 KVA GE, type Ht. late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

8—200 KVA GE, type Ht. late type, oil or pyranol cooled, 3 ph., 60 cy., 27060/125/216Y Mult or submersible type; attached to each transformer is GE automatic heavy duty network protector type MG-6 and heavy duty primary switch; complete with all accessories.

STATION-TYPE REGULATORS

4—68 KW indoor type Westinghouse constant current regulators, Type R.S., Prim. 2200 V., 60 cy., Amp. 6.6 & 7.5 Serial number 582020.

PHILADELPHIA TRANSFORMER CO.

2829 Cedar St. Phila., Penna.

HEAVY DUTY DIESELS

720 HP Fairbanks Morse model 33, 5 cyl. 580 KVA 2300 volt F-M Generator. Late type. Complete.

560 HP. Fairbanks Morse model 33, 4 cyl. 470 KVA 2300 volt F-M Generator. Late type. All accessories.

300 HP McIntosh Seymour 4 cycle, 3 cyl. 200 KW G-E 2300 volt Generator. Perfect shape. Very low priced.

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FOR SALE

2—160 h.p. Waukeshaw Natural Gas Engines with 125 KVA Generators
1—175 h.p. Model T, Foos Natural Gas Engine
2—80 h.p. Bruce McBeth Natural Gas Engines
2—250 h.p. Foos Natural Gas Engines direct connected to 219 KVA Generator
1—300 h.p. Miller Natural Gas Engine—200 KW Generator
2—400 h.p. Rathbun Jones Natural Gas Engine with Generator
1—400 h.p. Cooper Bessemer Natural Gas Engine
5—100 h.p. Y.V. Fairbanks Morse with clutches or generators
2—120 h.p. YVA Fairbanks-Morse with clutches or generators
4—240 h.p. YVA & Model 32, Fairbanks-Morse with clutches or generators
2—360 h.p., Model 32, Style VA, Fairbanks-Morse with 300 KVA generators

Other Units 75 h.p. up to 520 h.p.; also Steam Units, 37½ KW to 450 KW

A. C. ASKEW
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Tulsa 8, Oklahoma

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440*	West.	CW-232C
1	5	580	220*	G.E.	HI-9
6	7½	810	550	G.E.	MTC-5201
1	7½(new)	575	220*	G.E.	MT-522
2	10	1140	440*	West.	HF-7A
1	10	850	440*	Al.-Ch.	ARY
2	10	570	220*	G.E.	HI-11
3	11	810	550	G.E.	ITC-5008
2	11	685	220*	West.	CI-548
1	15	900	440*	G.E.	MTC-5302
2	15	570	220*	West.	CW-646
1	18	680	440*	West.	MW-316
1	20	1750	440*	West.	CW-471A
1	25	1130	550	G.E.	MT-323
2	25	850	220*	Wagner	BR
2	25	720	440*	Wagner	22VBR
1	30	865	440*	West.	CW-646
1	30#	850	440*	G.E.	MT-332
1	30	675	440*	G.E.	MT-336
2	35	600	440*	Fb-M.	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	690	440*	G.E.	MT-542
1	40	560	440*	G.E.	MT-346
1	50	860	440*	West.	HF-12A
5	52	550	220*	G.E.	IQC-5013***
1	60	1200	2200	G.E.	MT-B-343
1	60	685	440*	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-930-39
1	75	720	550	G.E.	MT-556
1	80	575	440*	G.E.	MTC-5352
1	100	1760	220*	Al.-Ch.	ARY-223BS
2	125	430	440*	G.E.	IL-16
2	150	1750	440*	G.E.	MTP-549
1	150	680	440*	West.	CI-856-C
1	150	490	2300	West.	CW-956A
1	150	385	550	G.E.	IM-17
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	I-17A
3	250**	296	220/380	West.	CW-20-53-15
1	300	514	550	G.E.	IM-17A
1	400	505	550	West.	CW

* Can be furnished for either 220 or 440 volts, but not both voltages.
** 50 Cycle (New). *** 2 Phase.
# Wound Rotor.

CRANE, MILL TYPE 230 VOLT—D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
2	3½	700	G.E.	CO-1803
1 (new)	10	650	G.E.	MD403BE
2	10	690	West.	K-4
3	10	575	G.E.	CO-1806
3	25	590	Diehl	TE
2	27	490	West.	MC-40
3* (new)	35*	600	West.	CK-9
1	50	600	West.	CK-9
5** (new)	50**	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	COM-1830

* Available with West. Type DW, Frame 135#, Style 487555, Shunt Wound Brakes.
** Available with G.E. CR9523B313M2. Cat. 823043–G24 Shunt Wound Brakes.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220*	Reliance	AA-B3247
2	20	1160	440*	West.	CS-554
1	25	1140	2200	West.	CCL
2	25	705	440*	West.	CS-W504-TEFC]
1	25	690	440*	G.E.	KT-336
1	30	870	220*	West.	CS-646
2	30	1160	440*	West.	CS-644
1	50	900	2200	G.E.	KT-346
1	50	850	220*	West.	CCL
1	75	1750	2200	West.	CS-761
1	100	495	2200	Al.-Ch.	AN
1	100	580	2200	G.E.	IK-15
2	100	500	2200	West.	CS-930
4	150	1800	440*	Howell	N-684
4	200	580	550#	G.E.	KT-5668
1	700	1800	2300/4000	West.	CD-4-39D-12

* Can be furnished either 220 or 440 volts, but not both voltages.
# Reconnectable for 440 volts.

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-63L
3	7½	850	G.E.	CD-75
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	West.	SK-93
5	15	825	West.	SK-90
3	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L

NEW MOTOR GENERATOR SETS (10)

Generator: Continental 2 KW, Type D, Frame 225P, 115 Volts DC, 1750 RPM, Compound Wound. Motor: Continental 3 HP, 3 Phase, 60 Cycle 230 Volt, Dripproof Protected.

New D C.. Generators (10)

West. 2 KW, 125 Volts, 1800 RPM, Type SK, Frame F225, Cont. 40°C., Style 6G4555, Sleeve Bearing.

VARIABLE VOLTAGE DRIVES (2)

40 HP, Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW, 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP, 400/1500 RPM, Frame 385T, 230 Volt. DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

NEW AIR CIRCUIT BREAKERS (5)

General Electric, 2 pole, Enclosed Manually Operated, Type AE-1B-Y1, 600 Volts, 60 Cycle, 220 Volt Shunt Trip, with Two Instantaneous Overload Trips Calibrated 600 to 1500 Amperes.

NEW A.C. GENERATORS

18—Leland, 2.5 KVA, 120 Volt, 1800 RPM, 60 cycle, Single Phase, Type AG, Frame 50, Form BOWJH, Continuous, Self-Excited.

The Above Listings Are Representative of Items Available for Prompt Shipment from Our Cleveland Warehouse.
We Also have a large Stock of Rotary Converters, AC and DC Generators, Circuit Breakers and Control Equipment.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

OVERHEAD CRANES

1¼ Yd. Foundry Crane 48'1½"

1-TON
Detroit 38' Span
Shepard Niles 12'

2-TON
Conco 12' Span
Chisholm Moore 25'

3-TON
P&H 42'1½" Span
Case 51'2" Span
P&H 37'6" Span

5-TON
Robbins & Meyers 20' Span
P&H 20' Span
Shepard 27'6" Span
Detroit 38'8" Span
P&H 75' Span
P&H 31'10" Span

6-TON
Northern 46' Span

7½-TON
Northern 26'7½" Span

8-TON
P&H 60' Span
Hand-Operated 12' Span

10-TON
Alliance 58'9" Span
Shepard Niles 27'7½" Span
Morgan 55'6" Span
Ederer 74'4" Span
Shepard 40' Span
2 Yd. Morgan 60' Span
Northern 49' Span
Shepard Niles 57'
P&H 87'6" Span
Niles 75' Span
Lane 60' Span
Shaw 80'9" Span
Ederer 70' Span
Toledo 77' Span
Whiting 48' Span
Shaw 67'6" Span
Morgan 38' Span

12½-TON
Niles 75'1" Span

15-TON
P&H 32' Span
Ederer 74'4" Span
New Albany 50'6" Span
Morgan 73'5½" Span
Morgan 82' Span
Bedford 34'6" Span
P&H 32' Span

20-TON
Lane 50' Span
P&H 51'4" Span
Ederer 74'4" Span
Northwestern 60' Span

25-TON
Bedford 14'6", 67'8", 46'2"
Leonard Burke 100' Span
Case 63' Span
New Albany 50' Span
Cyclops 74'4" Span

30-TON
Ederer 55' Span
Ederer 66'6" Span
Whiting 74'4" Span
Ederer 40' Span
Northern 75' Span
Bedford 25'9½" Span
Cyclops 74'4" Span

40-TON
Overhead Crane 150' Span

50-TON
Morgan 50' Span
P&H 40' Span

150-TON
Whiting 30' Span

200-TON
Alliance 100' Span

Telephone us collect to discuss your requirements

ECONOMY COMPANY, Inc.

49 Vanderbilt Avenue Telephone: MUrray Hill 4-1616 New York 17, N. Y.

POWER PLANT SPECIALISTS

SINCE 1912

SPECIAL OFFERING

6—400/500 HP Water Tube Boilers, 225 lbs. pressure, steel encased, late type cross drum—each boiler contains 309—3½" tubes, one 42" x 12' 11" steam cross drum, Todd Oil Burners, 3½" Duplex Safety Valves, Soot Blowers, all trim and accessories, ready for May delivery.

1—165 HP 125 lb. Pressure Economic Boiler
3—1200 HP 600 lb. Pressure Water Tube Boilers oil burning, superheaters, all trim and fittings including soot blowers etc—unused.
2—22500 lbs. per hour, 400 lb. pressure Water Tube Boilers, oil fired, superheaters, soot blowers —all trim and fittings.
4—38000 Pounds per hour. Sectional header. Water Tube Boilers—Unused—500# Pressure Complete with Superheaters—Economizers—Oil Burners, Soot Blowers.
1—4000 KW. 400 lbs. pressure, condensing turbo generators 3/60/2300/4100 volts.
1—3000 KW. 200 lbs. pressure turbo generator, condensing 3/60/2300 volts.

All types of TURBO GENERATORS, SWITCHGEAR, AIR and OIL CIRCUIT BREAKERS, RELAYS of all types. TRANSFORMERS, PUMPS, 800 VALVES—NEW and USED, up to 1500# pressure, and other items in Industrial and Power Plant Construction.

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HOWE BROTHERS

Turbine: Moore type S2R designed for 100 KW at 4000 RPM with steam at 250# initial pressure, 100° superheat and exhausting to 2# back pressure. Equipped with standard mechanical constant speed governor with hand speed changer, and standard accessories.
Gear: Size 6¾ x 6, speed 4000/1200 RPM.
Generator: 1200 RPM, 3 phase, 60 cycle, 240 volt, with silent chain driven excitor.
Couplings: High speed and low speed.
Baseplate: Under complete unit.

Control Panel with the following Equipment:
3-Pole oil circuit breaker G.E.-P.L. 87821 — #15933 USN-8394.
Ammeter Thomson type, 0 to 400 amps with current transformers type DS-6.
Voltmeter Thomson type, 0 to 350 volts, Field Rheostat.
Tirrell Voltage Regulator, G.E. #4997. Type 125, 25-125 cycles.
G.E. Polyphase Watthour meter #4105975—60 cycles 240 volts, type DS-6, Ratio 1, transformer 80-11.

All the above in first class condition and at a bargain price.

TAYLOR INSTRUMENT COMPANIES
P. O. Box 110 Rochester 1, N. Y.

BOILERS

2—400 H.P. Erie City, type E stokers, OHIO PENNSYLVANIA & ASME stamping.
2—400 H.P. Springfield sectional header, oil burners, N. J. & ASME stamping.
2—25,000# B & W Stirling's, unit pulverizers, National Board Stamping.

H. P. BREARLEY
3423-91st Street, Jackson Heights, N. Y.

NEW FLAT COPPER BUS BAR

353 lbs.	½" x 12½"	1321 "	⅜" x 11½"	70 lbs.	⅝" x 5"	1113 "	⅜" x 2½"
133 "	⅝" x 3½"	366 "	½" x 11½"	892 "	½" x 8"	5590 "	½" x 3"
1303 "	½" x 6½"	3400 "	½" x 8"	25000 "	⅜" x 1½"	6213 "	⅜" x 4½"
7000 "	¼" x 8"	97 "	⅝" x 4½"	3000 "	¼" x 10"	69 "	½" x 1½"
1000 "	½" x 8	1807 "	½" x 7"	652 "	½" x 1¼"	2845 "	½" x 1½"

COPPER TUBING

664 lbs. of .709 L.D. x 1.060 hard copper tubing.
ASTM Specification B-133-42T round copper.
2500 lbs. of 1¼" hard drawn type "B"
1200 lbs. of ¾" hard drawn type "B"
ASTM Specification B-133-42T round copper.

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PHILADELPHIA TRANSFORMER CO.
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COMPRESSORS
Vacuum Pumps

New & Guaranteed Rebuilts
Stationary & Portable

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Worthington Authorized Distributors

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

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FOR SALE

WESTINGHOUSE STEAM TURBINES

1—125 H.P., 2720 RPM
1— 40 H.P., 1825 RPM
200 H.P. and 250 H.P. 4150 volt across the line starting for synchronous motors

GUYAN MACHINERY COMPANY
LOGAN, W. VA.

APPLICATION ENGINEERS

45 KW M. G. Set 2200 AC 250 DC.
100 KW. M. G. Set 220/440 AC 125/250 DC.
300 KVA Fairbanks Morse Diesel Set.
200 KW 480 volt Ridgway Engine Set.
2500 KW 2300 volt 200 lb. GE Cond. Turbine.
150 HP 720 rpm 2200 volt GE Cage Motor.

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Rebuilt & Guaranteed

PUMPS—Large stock centrifugal—turbine—piston.

STEAM PUMPS—Duplex - Simplex. Reconditioned and guaranteed.

BOILERS—stacks—Engine Generators—condensers.

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PUMP & MACHINERY COMPANY
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NEW CHRYSLER DIESEL POWER UNITS

75 H.P. Model IND-3, 6 Cylinder, Electric start, includes: 4 Batteries, Radiator, and Spare Parts. Twin disc clutch.

ROSS HEAT EXCHANGERS
TYPE BCF

BCF LUBE OIL COOLERS

"YOUNG" RADIATORS
42" x 65"

ALL NEW. Immediate Shipment, limited supply.

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Sterling 3-6515

STEEL TANKS

9—8 ft. x 45 ft. Horizontal, 17,000 gal.
30—10,000 Gal. Cap. Horizontal.
250—4,000 Gal. Cap. Vertical.
7—42,000 Gal. Cap. Vertical.
3—5,000 & 10,000 Bbl. Cap. Vertical.

L. M. STANHOPE
Rosemont, Penna.

FOR SALE

Immediate delivery

DIESEL ENGINES

2—Winton Model 1920 3 cyl 10" x 14" 94 HP @ 300 RPM
3—Winton Model 1290 3 cyl 12½" x 16" 120 HP @ 250 RPM
9—Winton Model 1580 3 cyl 14" x 16" HP @ 270 RPM
1—Busch 3DF 17 3 cyl 13" x 17" 175 HP @ 300 RPM
2—DeLavergne 4 cyl 14½" x 13" 250 HP @ 270 RPM

PUMPS, HORIZONTAL DUPLEX RECIPROCATING

24—Prescott 6" x 24" capy. 20,000 bbls. per day 800#
13—Prescott 4⅝" x 18" 9,000 bbls. per day 800#

GENERATORS, DIRECT CURRENT

21—Allis Chalmers 25 KW 125 Volt Belt Driven
2—Westinghouse 25 KW 125 Volt Belt Driven
9—Allis Chalmers 15 KW 125 Volt Belt Connected to Model CSR6 gasoline engine

COMPRESSORS, AIR

8—Ingersoll-Rand, Type 20, two stage, 5" & 2½" x 4", with 74 HP Allis Chalmers direct current motors

Also water circulating and sump pumps, direct current motors and motor starters ½ to 7½ HP, switch boards and other items.

H. F. SWINDLE, *Purchasing Agent*

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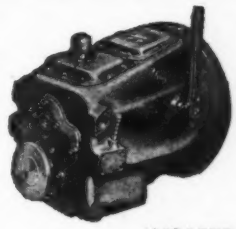
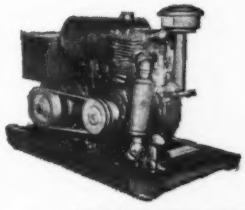


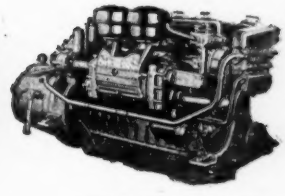
TWIN DISC TYPE CLUTCH

HOW WELL DO YOU KNOW YOUR EQUIPMENT

10 KW WESTINGHOUSE GENERATOR



2.5 KVA WESTINGHOUSE GAS. GENERATOR



GRAYMARINE DIESEL

NOW HOW WELL DO YOU KNOW PRICES

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MAIN 4-5181

These items and many others are for Immediate Delivery at

PRICES YOU KNOW ARE RIGHT!

Benjamin's for Motors
ESTABLISHED 1904
130 CLINTON STREET • BROOKLYN N Y

FOR SALE

GENERATOR

General Electric horizontal Generator—500 KVA 400 KW, 440/3/60, 658 amps. 180 rpm. Spec. #16313, form A, type ATB 40-500 KD. Serial No. 58106.

HOLYOKE WATER POWER CO.
Holyoke, Massachusetts

DIESEL GENERATOR SETS

1—360 HP F&M 14x17 cold start 257 RPM direct connected to 3/60/2300 Vt. F&M Generator. Rebuilt, $9500.00.
1—Same as above, good running condition $8500.00.
1—240 HP F&M 14x17, cold start, 257 RPM direct connected to 3/60/440 vt. F&M Generator. Reconditioned, $7750.00.

GENERAL MACHINERY & EQUIPMENT Co., Inc.
809 Woodland Ave., Kansas City 6, Mo.
Telephones VI-0018 & 0019

MOTORS

1—80 HP. 1200 RPM, CR. WH. 220/440/3/60 Ind.
1—75 HP. 1800 RPM U.S. Line Start 220/440/3/60 Ind. B.B.
1—65 HP. 1200 RPM, GE Type KT 220/440/3/60 Ind.
1—40 HP. 900 RPM, Whse. Type CW 440/3/60 Sl. Ring
5—5 HP. 2200 RPM Reliance, Ex. Proof, 230 V. DC.
1—Lot Whse. Type SK, 230 V. DC.
Other AC & DC Motors in Stock.
Cross Line & Reduced Voltage Starters.

TURBO ALTERNATORS

Complete with Auxiliaries and Control Equipment
1—3650 KVA 3600 RPM, 2300/3/60, Whse
1—3125 KVA 3600 RPM, 2300/3/60, Whse

MOTOR GENERATOR SETS

1—150 KW Ridgeway, 900 RPM, 250 V. D. C. to 225 HP. 2300 volt. Syn. complete with control equipment

TRANSFORMERS

1—200 KVA Kuhlman, Cont. Duty, Auto, 3800-2300/3/60
A few others in stock.

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TEL. 38-136,
CHARLESTON, W. VA.

We build SUB-STATION equipment to fit your requirements. Highest quality A. C. and D. C. Motors, Control Equipment and Transformers.

NEW and REBUILT

SYNCHRONOUS ROTARY CONVERTERS

6 phase 60 cycle

QU.	KW	Make	Speed	D.C.V.	Trans. V.
1	150	Whse.	450	250	2300/4160
1	500	Whse.	1200	600	#
2	300	Whse.	1200	600	#
1	300	GE	1200	600	#
2	150	Whse.	1200	275	2300/4160
1	150	GE	1200	275	#
1	300	Whse.	1200	275	#

Transformers, your spec. 3 to 6 months

SEVEN SPECIALS

Such as we must remove promptly from present foundations and priced specially low for quick sale

A COMPLETE PLANT—940 KVA Wghse. 3-60-2300 or 480 v. Cond. Turbo Generator Set. Also two 250 HP Murray WT Boilers, with Foster Superheaters and oil burners. 200# pressure. Completely overhauled, with turbine rebladed.

375 KVA GE-Worthington diesel engine; with dir. con. exciter and switchboard.

300 KVA GE 3-60-2300 or 480/240 v. alternator, dir. con. 18x30 Murray Corliss engine; 150 RPM. With belted exciter. Completely overhauled.

375 KVA GE Cond. turbo unit; 3-60-2300 v. with surface condenser, exciter and switchboard.

110 KVA Al. Chal. 3-60-240 v. alternator with Elliott non-cond. turbine; exciter and switchboard.

Natural Gas Unit. 375 KVA, GE, 3/60/480 oblique 240V. with Cooper Bessemer Gas Engine with dir. con. exciter and switchboard. "Overhauled".

Steam Turbo Generators Set 1250 KVA GE turbo units. 3-60-600V., 250#, 18 stage with surface condenser etc.

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POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.

MOTORS (Rebuilt) IN STOCK

Direct Current

H.P.	Make	RPM	Volts
1/2	Whse.	550	230
1/2	Whse.	550	230
1/2	Whse.	600	220
1/2	Whse.	550	230
3/4	G.E.	1725	110
1	G.E.	1150	230
1	G.E.	3450	230
1	Cr. Wh.	900	230
1	G.E.	1150	220
1	G.E.	1170	230
1	G.E.	1140	230
1½	Whse.	1180	230
1½	Whse.	1200	220
2	Star	3400	230
2	G.E.	3450	230
2	G.E.	2200	230
2	Cr. Wh.	1600	230
2	Master (Geared head)	1725	230
2½	El. Dy.	1350 to 3000	230
2½	Fort Wayne	600 to 1800	230
3	Al. Ch.	1150	230
3½	Cr. Wh.	1150	230
5	G.E.	1600	550
5	Star	1200	525
5	Star	1200	525
5	G.E.	800	500
5	G.E.	3450	230
5	G.E.	1000	110
5	Cr. Wh.	1875	230
5	N. W.	1150	220
5	Al. Ch.	1150	220
5	Peerless (with base)	1480	220
5	Al. Ch.	1500	220
5	Jenney Elec.	1700	220
5	N. W.	1150	230
5	Cr. Wh.	1425	230
5	Whse.	400 to 1600	230
5	G.E.	1600	550
7-2/10	Deihl El.	1150	230
7½	Whse.	3450	230
7½	Whse.	850	230
7½	El. Dy.	550 to 1100	575
7½	N. W.	1750	220
7½	Star	1800	230
7½	Bullock	1650	550
7½	G.E.	500 to 1000	500
10	Sprague	1700 to 1950	220
10	El. Dy.	600 to 1200	230
10	Cr. Wh.	850	500
10	G.E.	1150	500
10	G.E.	1125	500
10	G.E.	1500 to 1800	400/600
11½	W. E.	650	230
15	Reliance	850	230
15	Whse.	Variable	230
15	Whse.	825	230
20	Cr. Wh.	1830	240
20	(no name plate)		
25	Whse. (Crane)	570	500
25	G.E.	865	550
50	Whse.	840	500
66	G.E. (Crane)	520	230
100	G.E. (Auto. Control)	210	230

ALTERNATING CURRENT

3 phase, 60 cycle

1	Phoenix, with base	1800	220
1	G.E., 4-speed	1800/1200 900/ 600	220
1	Hobart	1800	110
2	Whse.	3450	110/220
3	Whse.	850	220/440
5	B-line	1750	440
7½	Triumph	1800	440
7½	Phoenix	1800	220
7½	Whse., Vertical	1740	440
7½	Whse., S. R.	870	220
7½	Fort Wayne, S. R.	1200	220
10	Al. Ch., S. C.	680	440
15	G.E.	865	440
15	G.E.	865	440
15	W. E.	865	220
15	G.E.	865	440
15	G.E.	865	440
15/35	Whse., S. R.	575/1160	440
20	G.E.	1155	2200
20	G.E., S.R.-base	855	2300
20	G.E.	855	2200
20	Al. Ch., S. R.	860	440
20	G.E., S.R.	865	440
25	Watson	1140	220
25/12½	L.-A., 2-sp. with base	900/450	220
25	G.E., S. R.	670	220
35	G.E. with base	600	2200
35	G.E.	860	440
50	Fynn-Weichsel	1800	220
50	G.E., S. R.	860	2200
50	Whse.	1160	2200
50	Al. Ch., S. R.	580	2200
75	G.E.	575	2200
100	G.E.	430	2200
150	G.E.	575	2200

Guyan Machinery Co.

LOGAN, WEST VIRGINIA

FOR SALE

1—NEW TERRY Model C-2, 500-KW, 1800 RPM, Non-Condensing Turbine, 175# p.—5# Back Pressure, Serial No. 19036, Direct-Connected to:

1—GENERAL ELECTRIC 500-KW, 80% P. F., 625 KVA, 3-phase, 60-cycle, 240-480 or 2300 volts, 1800 RPM, GENERATOR, with a Direct-Connected 7½-KW Exciter. Generator Serial No. 5,636,793.

Turbine suitable WITHOUT CHANGES for maximum conditions 250# pressure, 500 degrees TT and 50# G. Back Pressure.

ALL NEW IN 1944 AND NEVER USED!

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in

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POWER PLANT EQUIPMENT
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TRANSMISSION LINE MATERIALS

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EBASCO SERVICES INCORPORATED
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FOR SALE
COMPLETE
STEAM-ELECTRIC GENERATING PLANT

Now in Operation at Toledo, Ohio

3—AMES UNIFLOW VERTICAL ENGINES with direct connected Crocker-Wheeler D.C. Generators 400-500 & 600 K.W. 2 Wire, 250 Volts

ERIE CITY CROSSDRUM W.T. BOILER 514 H.P. with Detroit Multiple Retort Stoker

3—SPRINGFIELD WATER TUBE BOILERS EA. 408 H.P. with Taylor underfeed Stokers

ELLIOT DEAERATING FEEDWATER HEATER, 75,000 lbs. per hour

3—CENTRIFUGAL BOILER FEED PUMPS 190 G.P.M. 1—Motor Drive—2—Turbine Drive

NASH—L-3 VACUUM PUMP, Turbine Drive, 200,000 Sq. Ft. E.D.R.

FORCED AND INDUCED DRAFT FANS, BAILEY-REPUBLIC METERS and other Boiler-Engine Room Auxiliaries

For Further Particulars Address

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330 West 42nd St., New York, 18, N. Y.

FOR SALE

One G.E. Static Condenser #50285, indoor type, 60 cycles, 300 KVA, 2300 Volts, with reactor and oil circuit breaker.

One Panel Switchboard.

One Northern Engineering 4 ton, 46' span. DC Electric crane, complete with runway and motor driven converter.

One complete explosion proof lighting system.

For Further Information write to

KLATZKY BROTHERS

Box 295, Newberry, Michigan

FOR SALE

CLIMAX AIR COMPRESSOR

Size 10 x 10 x 10, steam driven, single quarter box, with Meyers valve gear and unloading device.

FS-294, Power
330 West 42nd St., New York 18, N. Y.

FOR SALE

SYN. MOTORS

Two (2) New 60 H.P. G.E. 1200 R.P.M., 220 V., 60 Cy., .8 PF Synchronous Motor with direct connected exciters complete with starters, in original crates.

TATE FURNITURE COMPANY
High Point, N. C.

KIEMLE OFFERS

Rebuilt and Sold with a Standard New Guarantee

IND. FREQUENCY CHANGER SETS

MOTOR GENERATOR SETS
ALTERNATORS, ALL FREQUENCIES
TRANSFORMERS, LARGE STOCK
D. C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D. C. Motors
230 Volts D. C. Motors
550 Volts D. C. Motors

THE FRED W. KIEMLE CO., 33 N. SUPERIOR ST., TOLEDO 4, OHIO

Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

Hydro-Electric Equipment

1—400 KW G.E. vertical 3 phase 60 cycle 600 V 180 RPM with motor generator set for excitation. Electric drive Woodward governor. Complete switchboard with all accessories, also 2 electric drive head gate hoists, 18 to 23' head.
1—400 KW G.E. horizontal 2 bearing alternator 3 phase 60 cycle 2300 V 180 RPM.
1—G.E. vertical alternator 3 phase 60 cycle 2300 V 164 RPM.
1—Automatic control 150 KW complete hydro-electric plant 3 phase 60 cycle 2300 V for 80-100' head.
1—Horizontal plant, belted generator 200 KW West. Elec. 3 phase 60 cycle 2300 V 600 RPM with twin Rodney Hunt, 24" Turbines and Woodward governor for 18-24' head.
2—Leffel scroll horizontal 18" turbines for heads from 50-200'.

Many others of various sizes and heads available. All subject to prior sale. Also some D.C. motors and generators from 1 hp to 40 KW. All inquiries given prompt attention.

WM. C. MOULTON ASSOCIATES,
Monson, Mass.

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STEAM ENGINE

Fleming piston valve, side crank steam engine. Direct connected to G.E. Type A.T.B., A.C. generator, 3 phase, 220 volts, 315 amps, 120 K.V.A., 225 R.P.M.
Rugged type generator, will stand considerable overload.

Apply—MERRIMAC MILLS COMPANY
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TEMPERATURE RECORDERS

Three brand new Taylor Temperature Recorders one from 0° to 225° F; two from 100° to 350° F. Still in original containers. Write, wire or call for complete specifications and price.

BELVIDERE DISTILLING CO.,
Belvidere, Illinois
Phone 103

FOR SALE—Bargain

1—750 K.W. 250 volt Direct Current Steam Engine Generator Set, 120 R.P.M. Allis Chalmers 30" x 42" Corliss Engine, Generator, Switchboard and accessories. Excellent condition. May be inspected in operation at 155# steam pressure in Long Island City, N. Y.

HUGH A. BROWN, *Agent*
235-39 36th Ave., DOUGLASTON, L.I., N.Y.

Surplus Motors

FOR SALE

Quantity	H.P.	R.P.M.	Quantity	H.P.	R.P.M.
1	1	550	1	7½	3600
3	1	1800	1	10	1200
2	1	3600	2	10	3600
4	2	1800	1	13	900
4	2	3600	2	15	1800
14	3	1800	1	20	1200
1	5	1200	1	25	900
1	7½	900	1	25	1200
1	7½	1200	1	35	900
2	7½	1800	1	40	900

These are all general purpose motors except the 13 H.P. which is a high torque motor, and are all in good condition and priced right for quick sale. All motors are 3 phase, 60 cycle, 220 volt.

We also offer the following surplus Equipment:

One Worthington 1500 G.P.M. Pump Unit, Size 6" Class BS Pump, direct connected to 25 H.P., 1800 R.P.M., 3 phase, 60 cycle, 220 volt G.E. motor, all mounted on unit base.

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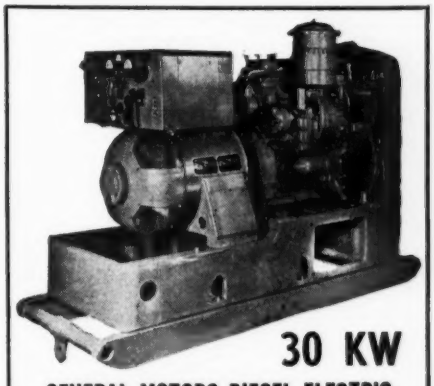
for complete description and prices

FARLEY & LOETSCHER MFG. CO.
DUBUQUE, IOWA

FOR SALE
DIESEL GENERATOR

One 4 cylinder 240 HP Type Y VA 2 cycle Fairbanks Morse full Diesel direct connected to 220 volt AC generator with exciter, switchboard, all complete. New type cylinders and heads. All in excellent condition.

GARDEN FARM DAIRY
P. O. Box 363 Denver, Colorado



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GENERAL MOTORS DIESEL ELECTRIC
GENERATING PLANTS

50 or 60 cycle operation. 30 KW—127/220 volts, 60 cycle; or 25 KW—230/400 volts, 50 cycle.

ALSO AVAILABLE

4—100 KW MURPHY ME—650 GENERATING PLANTS
127/220 volts, 50/60 cycle generator

6—60 KW GENERAL MOTORS DIESEL ELECTRIC PLANTS Model 6016E
50/60 cycle units, 127/220 volts at 60 cycles

10—15 KW INTERNATIONAL HARVESTER DIESEL ELECTRIC GENERATORS

All units brand new and guaranteed.
Priced below market for quick sale.

OLD COLONY EQUIPMENT CO., INC.
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PHONE MO unt Vernon 8-9600

AIR COMPRESSORS

2—3874 FT. CAP. Chicago Pneumatic 700 H.P. 3 PH. 60 CY. 2300 V. Class OCE, Latest Type Practically New Air Compressors, with Receivers and Aftercoolers.

Immediate Delivery

R. C. STANHOPE, INC.
60 East 42nd St. **New York 17, N. Y.**

DIESEL ENGINES

200 H.P.—500 H.P.

MEDIUM SPEED

Brand New

IMMEDIATE DELIVERY

30% DISCOUNT

STANDARD MAKES

NO BROKERS

FS-308, POWER

330 West 42 St., New York 18, N. Y.

Complete Railway Substations

FOR SALE

Motors—2300 - 3 P. - 60.

No. 1—West. MG Set, SYN, 720 H.P.—800 RPM. 2—300 KW, 600 V. Gen. with GE Automatic Switchgear

No. 2 and 3—Each GE, MG Set, Ind. 750 H.P.—714, RPM 500 KW GEN. 1200 volt with GE Automatic Switchgear

No. 4—West. MG set, Ind., 585 H.P.—500 RPM 400 KW—800 V.—manual switchgear.

No. 5—GE MG set, Ind., 450 H.P.—720 RPM —300 KW.—manual switchgear.

Indoor Transformers

6—GE—H.P. 275 KW—17/34/60 KVY to 2200/2000 water cooled.

3—West.—275 KVA—35/60 KV to 2200 air cooled

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Available July 1st, 1947 — Three steam engine generator units, total capacity 1125 KVA—90 KW, 208/120 V., 3 phase, 60 cycle.

ENGINES — Skinner Engine Company three cylinder, vertical, universal uniflow, central exhaust, 14" x 16", 400 RPM, steam supply 150 psig, exhaust 4 psig.

GENERATORS—General Electric Company direct connected 375 KVA, 300 KW, .8 PF., 40° C rise.

EXCITERS — General Electric Company, D. C. generator V-belt driven, 120 V, 10 KW, 40° C rise, 1750 RPM.

Complete with switchboard equipment, indicating voltmeters and ampmeters, voltage, regulator, circuit breakers, synchronizing equipment, miscellaneous electrical and mechanical appurtenances, and spare parts. Condition of all units good and in continuous service at present. Complete data available upon request.

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"EVAPORATORS"

Four Griscomb-Russell evaporators #147-2-240, style F, horizontal, high pressure, bent tube, self-scaling. Steam working pressure 150# at 80° super heat. Water pressure 100# per square inch gauge. Capacity 80,000# distilled water per hour. Conforms to A. S. M. E. and State of Michigan code, with or without all necessary connecting pipes and valves.

FS-309, Power

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FOR SALE

G.E. Air Circuit Breakers 600 v. 60 cy. 3 wire, 2 coils.

2—800 amp. 5—1600 amp. Practically new.

3—ITE enclosed circuit breakers 220 v, 600 amp.

36—Bulldog Busduct safety switches, Cat. #14355. 400 amp. 575 v.

W. FURLONG — Sacramento 4000.

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One (1) BROWNELL, Type C-150, screw type stoker complete, 5 H.P. AC motor, capacity 750 lbs. p/hr. continuous load, 900 lbs. p/hr. peak load, hopper capacity 1200 lbs. Excellent condition.

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1—65 K. W., 230 Volts, 3 Phase, 60 Cycle, Ideal Piston Valve Generator Set, F.O.B. Cars

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FOR SALE

Set 4 B&W 1943 Complete

Boilers Formula:

$\frac{11}{42}$ $\frac{4\frac{1}{2}\ (4\text{-}2)}{1\ (4\text{-}2)}$ 9'0" $\frac{0}{TS}$ WP 280#

1—Two DC Turbine Gen. Set 50 & 60 Kw. 125V. 1800 RPM & Switchboard.

MAXIMILIAN GOIN AND ASSOCIATES

(Engineers)

510 Battery Street San Francisco 11, California

FOR SALE

USED MOTORS

Direct current from ¾ HP to 35HP; write for full particulars.

THE FRANK TEA & SPICE CO.

CINCINNATI, OHIO.

FOR SALE

UNDERFEED SINGLE STOKER

Practically new Combustion Engineering Type E with steam piston 8 ft. x 6 ft. 10". With extension hopper and 72 fire bars both movable and fixed.

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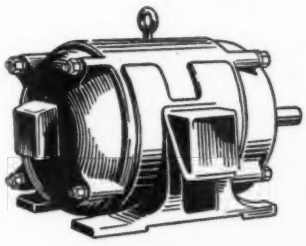
We offer, subject to prior sale, the following brand new motors:



220/440 V.—60 CYCLE—THREE PHASE

Qu.	H.P.	Make	Type	Speed	Description
40	½	Shelby		1750	BB Open
45	½	Wagner	Fr. 204	900	Ex. Proof—T.E.B.B.
10	¾	Shelby		1750	BB Open
3	1	Delco		1200	T.E.F.C.B.B.
15	1	Shelby		1150	Open

SPECIAL

All Single Phase—110/220 V., 60 Cycle. 1750 RPM

50	½	Walker Turner			
10	¾	Westinghouse			
10	1	Eichor			
17	1	GE & West.		1800	Open
13	1	GE & West.		1150	Open
48	1½	GE & West.	K224	1800	Open
1	1½	GE	K203	3450	BB

20	2	Cent. & West.	224	1800	BB
8	2	GE & West.		1800	T.E.F.C.B.B.
10	2	West.	cap 224	1200	BB
2	3	Reliance		900	Open B.B.
2	3	Delco & Reliance		1200	T.E.F.C.B.B.
4	5	GE & Cent.	Fr. 284	1200	SB & BB Open
10	5	West. & F.M.	Fr. 284	1800	T.E.F.C.B.B.
5	5	B & B		1800	Splash proof
1	7½	Cr. Wheeler	Fr. 284	1800	B.B. Open
2	7½	Westinghouse		900	B.B. Open
1	15	Westinghouse		900	S.B. Open

SPECIAL

EXPLOSION PROOF MOTORS

20—1 HP Allis Chalmers 220 Volt only, 60/3 1800 RPM
20—2 HP Allis Chalmers 220/440 V., 60/3 1800 RPM

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P. O. Box 304

SONDERS ELECTRIC EQUIPMENT CORP.

SYRACUSE 3, N. Y.
Telephone 9-7843

STEAM POWER PLANT EQUIPMENT

FOR SALE

2—748 H.P. Edge Moor cross drum water tube boilers, 250 pounds, 125 degrees super-heating.
2—7 Retort Riley underfeed Super-Stokers.
3—90 G.P.M. Boiler feed pumps, two steam driven, one motor driven.
1—150,000 pound cast iron Cochrane de-aerating feed water heater.
1—Induced draft fan.

All of above equipment in excellent condition and now in operation. Must move quickly for replacement with larger equipment. For quick sale as is.

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Greenville, N. C.

COND. TURBO GEN.

1—Practically new, 2000 KW Westinghouse condensing turbo generator unit with practically all auxiliaries, including condenser, etc., generator air cooler, etc. Turbine Inlet 275#G, Extracting at 5# and 45# Pressure. Generator rated 2500 KVA, 80% P.F., 3 phase, 60 cycle, 480 volts. Details upon request.

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TWO 250 H. P. BOILERS

Type C, horizontal bent tube, water tube Erie City Iron Works Boilers, tested for maximum steam working pressure 200 lbs., new November 1940. Have had first-class maintenance and are complete with all their accessories. Oil burners and grates for both boilers. This plant is now operating.

ALSO

One building housing these boilers; frame construction, sheet-metal covered; can be removed and sections re-erected. Call or write J. G. Alexander

NATIONAL FIREWORKS, INC.
WEST HANOVER, MASS.

FOR SALE

DIESEL GENERATING PLANT

Consisting of:
2—47 H. P. Ruston-Hornsby Diesels
2—35 K. W. 220-240 Volt, 3 phase A. C. Star Generators
2—220 Volt Fuel Pumps

Complete with switch board and synchronizing equipment. This plant may be seen in operation. Can be run single or dual. Engines are V-belted to generators.

SISCO DAIRY CO.
CLIFTON, NEW JERSEY

FOR SALE

1—Link-Belt Bulk-Flo Elevator-Conveyor, capacity 10 tons per hour
1—Hand-propelled Weighing Larry with recording scale, capacity 2000 pounds
2—Flynn & Emrich 8 x 6 Hydromotors, complete for oil operation
1—Flynn & Emrich #3 Pressure System Above equipment installed summer of 1944. Reason For Sale: Conversion from coal to oil.
1—200 KVA AC Generator with direct connected exciter, complete with bearings and switch board.

THE ATLANTIC WIRE CO.
Branford, Conn.

D. C. Steam Engine GENERATOR SETS

General Electric, 300 K.W. 175 R.P.M., 125 volt, driven by Chuse cross compound 17" x 28" H.P. 28" x 28" L.P.
Sprague, 250 K.W. 180 R.P.M., 125 volt, driven by Chuse 4 valve 20" x 24"
Western Electric, 175 K.W. 180 R.P.M. 120 volt driven by Ball—4 valve 18" x 24"
Westinghouse, 125 K.W. 180 R.P.M. 120 volt, driven by Chuse—4 valve 14" x 21"

Contact: Julius Boehmer, Jr.

RICE-STIX DRY GOODS CO.
1000 Washington Ave., St. Louis 1, Mo.

FOR SALE

Jeffrey Manufacturing Company coal handling machinery consisting of the following:

Equipment to handle coal discharged from bottom of Gondola cars into track hopper, plate feeder to receive from hopper and deliver to bucket elevator, bucket elevator approximately 45' in height and scraper conveyor to distribute coal over top of bunker. This equipment installed and in operating condition can be seen by contacting Maurice Tiernan

c/o MAPLE ISLAND FARM, INC.
New Richmond, Wisconsin, Tel. 123

FOR SALE

BOILERS

2—UNION Double-Longitudinal drum water tube boilers—406 H.P. each—200 pound pressure, 125 degrees superheat—with Combustion Engineering. Four (4) Retort Fredrick Underfeed Stokers—Diamond Soot Blowers, Cash over furnace draft control, Bailey meters and draft gauges. Can be seen in operation.

BROWN & BIGELOW
St. Paul, Minn.

FOR SALE

2—600 H.P. Springfield Crossdrum Boilers complete with Harrington stokers, including steel structure, soot blowers, superheaters, forced draft fan and vertical reciprocating steam engine 8 x 8. Approved for 200# working pressure. Completely dismantled ready for immediate shipment.

MIDWEST MFG. COMPANY
Galesburg, Illinois

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FAIRFIELD
coal handling system

One of the most efficient and dependable methods of handling coal is the Fairfield skip hoist.

Shown is a 60 cu. ft. skip hoist with a 91 ft. lift, elevating the coal to hoppered bottom coal bunkers inside the plant. The system has a capacity of 50 tons per hour.

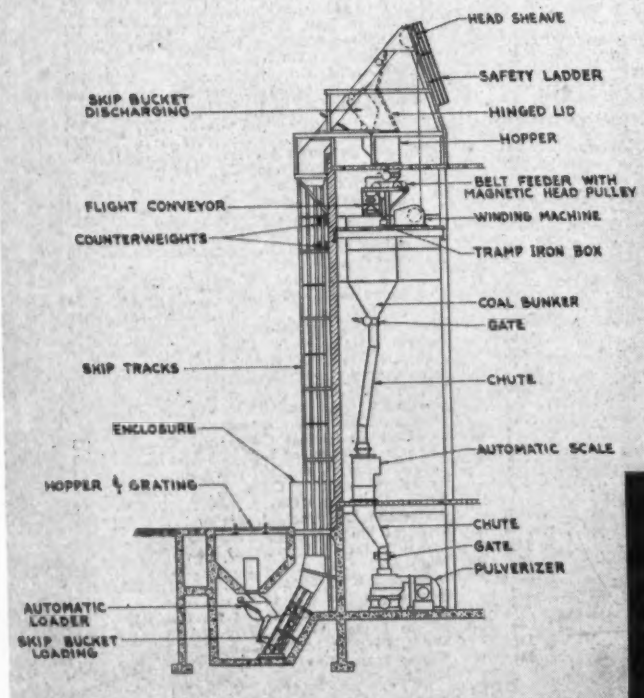
At the skip discharge the coal is passed over a magnetic belt feeder which removes tramp iron. The coal is then distributed to the bunkers by a double strand roller flight conveyor. It is then weighed as used and delivered to the pulverizers.

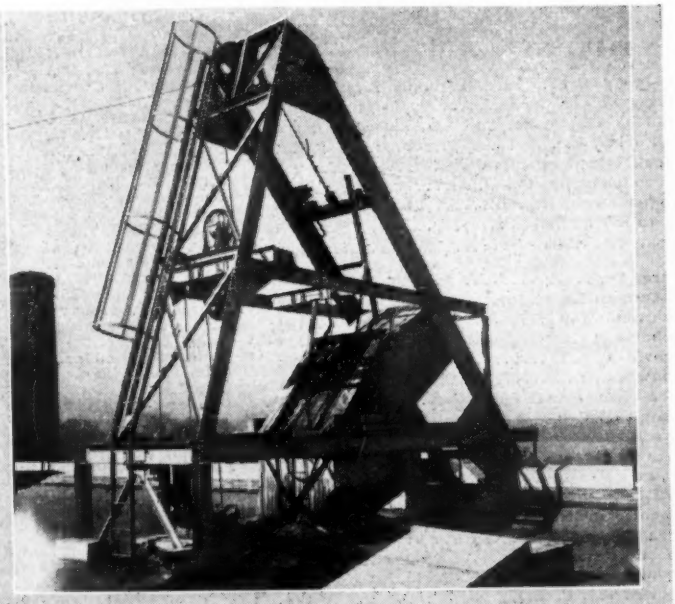
This installation was designed—built—erected by Fairfield to meet the specific needs of this plant.

Fairfield Engineers will gladly do the same kind of a job for you. Why not write us for complete details today.

Above—Illustrating skip hoist on outside wall of power plant.

Right—Shows skip hoist superstructure on roof of power plant.





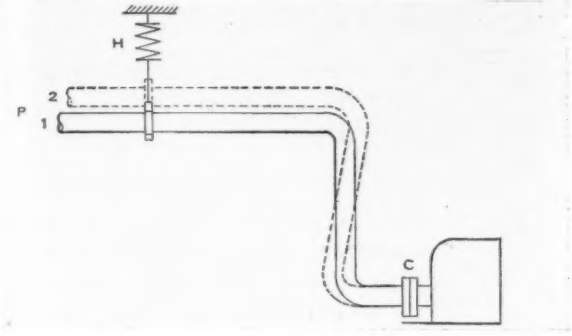
THE FAIRFIELD ENGINEERING CO.

Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE · · MARION, OHIO

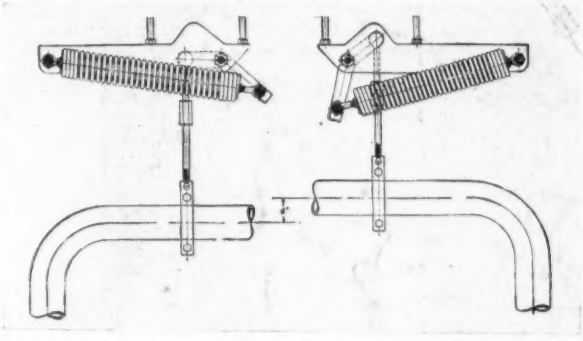
Are Weight Transfer Stresses Endangering Your Piping System?

THE PROBLEM:

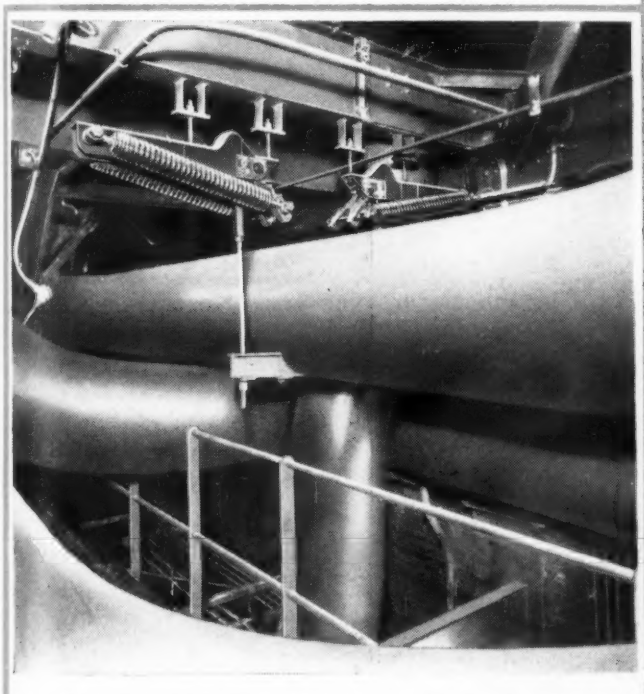


If the full safety factor is to be maintained in piping, then any weight transfer stresses caused by vertical movement of piping due to expansion or contraction, load change, surge or vibration must be eliminated. Diagram illustrates this problem—if pipe hangers "H" do not support full weight of the piping "P" in both cold position "1" and hot position "2", then dangerous stresses may result at connections "C".

THE SOLUTION:



Provide constant support to the piping throughout the entire range of vertical movement with Grinnell Constant-Support Hangers—the *only* constant support hangers. A lever, turning on the main pivot, balances the weight of a vertically shifting load because the change in moment arm with lever rotation is such that the product of the moment arm and the spring force is always constant and equal to the weight of the piping system.



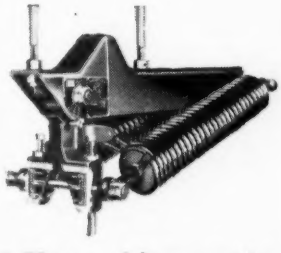
Main steam line at Hell Gate Station of Consolidated Edison Company is provided constant support by Grinnell Constant-Support Hangers.

GRINNELL CONSTANT SUPPORT HANGERS

— the ONLY Constant-Support Hangers

FEATURES:

- Constant support of piping in all "Hot" and "Cold" positions.
- Full safety factor of the supported system is always maintained.
- Non-resonant, energy absorbing.
- Mass-produced from standard precision parts.
- Individually calibrated for each installation.
- Load-adjustment features incorporated into the design.



- Three models meet entire range of load-travel specifications.
- Minimum headroom required.

Write for data book containing complete details.

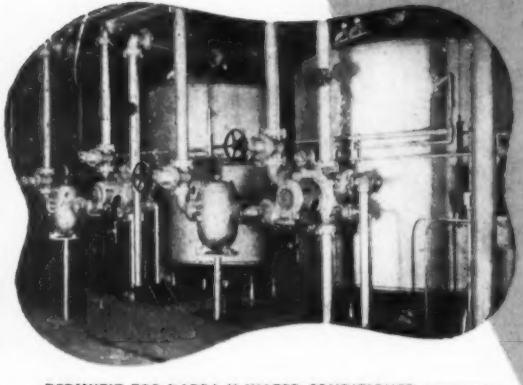
GRINNELL COMPANY, INC.
Executive Offices, Providence 1, R. I.
Branch warehouses in principal cities.

GRINNELL

FOUNDED 1850

WHENEVER **PIPING** IS INVOLVED

"Sure takes a load off my mind"



PERMUTIT ZEO-KARB* H WATER CONDITIONER removes both hardness and bicarbonates from water. Effluent contains no incrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.

*Trademark Reg. U.S. Pat. Off.

No boiler scaling or corrosion with Permutit-conditioned water

It's a big load off the minds of management, too—once a plant is equipped with Permutit* Water Conditioning. Heavy power loads can seriously damage equipment, and even tie up production. For, as any operating engineer knows, the danger of boiler scale and corrosion of steamlines due to impurities in feedwater *increases* with the load.

Permutit removes this threat to output by removing the impurities in feedwater *before it enters the boilers.* Water conditioning headquarters for the power industry, Permutit provides *every* process for control of water quality.

Don't let untreated water constantly threaten the operating efficiency of your plant. Take a load off your mind . . . bring that water treatment problem to The Permutit Company, Dept. P5, 330 West 42nd Street, New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT

Manufacturers of ALL types of water treatment equipment

WATER CONDITIONING HEADQUARTERS

"It's good business to begin with Good Water"